EPIDEMIOLOGY OF DISEASES OF NAVAL IMPORTANCE IN CHINA

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FOREWORD

The purpose of this manual is to present a condensed picture of the prevalence, distribution and epidemiology of infectious diseases of naval importance in China together with information on the distribution, habits, and identification of vectors and reservoir hosts. Although the manual is generally applicable to all of China special emphasis is placed on the coastal provinces and the special problems which they present. The area encompassed is tremendous; in many instances adequate information does not exist and in some instances sources of important information were unavailable. Primary emphasis is placed on those diseases which can involve large numbers of naval personnel and which may present epidemiologic and control problems different from those experienced elsewhere by the medical and H(S) officers of the U. S. Navy. Hence although in China the respiratory diseases are the most important cause of mortality and morbidity, more attention is placed on the arthropod-borne diseases and helminthiases because the latter will present more novel situations to our personnel.

Many sources have been channelled into the preparation of this manual. Classified intelligence reports have been an important source. Many of these are the contribution of persons, both professional and non-professional, of long residence and experience in China. In the assembling of information on the distribution and identification of vectors and reservoir hosts the collection of the U. S. National Museum have been used extensively. Personnel of this institution and of the Division of Insect Identification of the U. S. Department of Agriculture have contributed much information. With the exceptions of Appendices B, C, D, E, and F the entire manuscript was prepared and written by Dr. T. Y. Hsiao, Specialist, Division of Preventive Medicine. The important sources of information have been various scientific journals. Among the Chinese journals used extensively are China Medical Journal, Chinese Medical Journal, National Medical Journal of China, Lingnan Science Journal, Bulletin of the Fan Memorial Institute, Peking Natural History Bulletin, and many others. The Transactions of the Far Eastern Association of Tropical Medicine, Bulletin de la Societe de Pathologie Exotique, Archiv fuer Schiffs-und Tropenhygiene have been sources of important papers. Much information of importance has been derived from American and British journals and to a lesser extent from Japanese technical journals. Various Russian monographs and papers have been important sources of information on north China. The bibliography contains a list of the published sources of material. Most of these publications are available on microfilm from the Photoduplication Service, Army Medical Library, Seventh and Independence, Washington, D. C. This service is extended to officers of the medical department of the U. S. Navy. Microfilms will be sent by airmail if airmail postage is provided.

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INTRODUCTION

The vast area of China which includes one twelfth of the total land mass of the world extends from typical tropical regions in the south to the cold temperate regions of the autonomous Soviet Republics in the north and from the Pacific coastal areas in the east to the high Pamir Plateau in the west. This vast expanse includes a variable array of almost every known type of physiographic feature. In Tibet there exists one of the highest inhabited areas in the world, while the oasis of Turfan in Chinese Turkestan is in places more than 200 meters below sea level. There are vast sedimentary flood plains along the lower parts of the Huang-ho (Yellow River) and the Yangtze as well as in the valley of the West River in Kwangtung Province. Hilly lands above 500 meters are found in the middle valleys of the Huang-ho and Yangtze and in Fukien Province along the coast. The Yun-Kwei Plateau in the southwest is over 1000 meters above sea level and mountains more than 3000 meters high are found in Sikang and Tibet.

In a country so vast and so varied in its topography, the climate is likewise diversified. In temperature it ranges from arctic rigor in north Manchuria to torrid heat of the coral islands in the South China Sea. Precipitation varies from less than 40 mm. per year in the Gobi Desert to over 7,900 mm. per year at Mount Omei in Szechwan Province.

It is not within the scope of this manual to discuss in detail the topography and climatology; nevertheless, since these factors are of such fundamental importance in the distribution of disease a brief general discussion together with some data on temperature, precipitation and humidity appear desirable.

The divisions of north, central and south China, though arbitrary, seem to be convenient for our purpose. North China includes the territory north of the Tsinling range of mountains and lies for the most part, north of 33° north latitude. It includes the whole valley of the Yellow River where the worst floods and famines of all China occur. The rainy season comes in summer and the rainfall is small. In this region the winter is cold, and dry, especially toward the north.

In Liaoning, Manchuria, the winter is cold, with temperatures occasionally as low as -30° F. or even lower. Usually there is not much snow. Summer maximum is about 95-100° F. Rainfall is heavy in July and August. In Hopei Province and Shantung Province, the average temperature is about 55° F. The rainfall is variable and restricted to a short period in the summer. This is especially true of the northwestern provinces.

Central China includes practically all of the great basin of the Yangtze River and its tributaries, the valley of the Hwai River, and the province of Chekiang, the northern part of which is geographically related to the adjacent parts of Kiangsi Province and Anhwei Province. The dominant unifying factor in this region is the great Yangtze basin which may be said to consist of a series of minor basins, each centering in a lake region. The climate of central China is temperate and is not subjected to great variations. The summer is hot and humid, the spring and fall are long and pleasant, and the winter is moderate. The climate is uniform over the whole region with a mean annual temperature close to 60° F.; freezing temperatures occur rarely in the winter. The rainfall is much heavier than in the region further to the north and is well distributed throughout the warm season.

South China, including all the provinces with most of their area below 26° 30' north latitude, is geographically more heterogenous than central China. Fukien Province is transitional with its northern part more or less similar to central China. Both Kwangtung and Kwangsi are in the valley of the West River. The southwestern highland provinces are characterized by the so-called Yun-Kwei plateau and are geographically similar to Burma and Tonkin. In general, south China has a tropical and subtropical climate and abundant rainfall.

Appendix A contains data on climatologic conditions in certain representative localities of China, as reported in the China Handbook, 1943.

It is estimated that China has about one-fourth of the total population of the globe. No census of the entire population of the country has ever been taken and consequently estimates and reports on the total Chinese population have varied considerably. According to the estimate of the Post Office the population for 1922 was 436,094,953. The Ministry of Interior gives the population as 459,339,764 for 1940. About 85 percent of the population are farmers and by far the great majority of the people inhabit the coastal provinces. Table 1 shows the population of certain large cities as estimated by the Chinese Post Office.

TABLE 1

POPULATION OF CERTAIN LARGE CITIES IN CHINA*

City	Estimated Population
Shanghai	3,558,111
Nanking	902,941
Mukden	889,647
Peiping	1,220,832
Harbin	216,838
Amoy	473,058
Hangchow	1,136,060
Tsingtao	592,800
Tsinan	662,642
Canton	3,156,698
Hongkong	900,812
Soochow	865,800
Swatow	647,652
Tientsin	1,250,539
Wuhan	1,948,274
Ningpo	1,041,455
Foochow	1,508,630
Changsha	1,243,044

* Chu and Lai (1935)

The population density is highest in the coastal provinces. Kiangsu has 867 persons per square mile, Shantung 676, Chekiang 542, Hopei 529, Kwangtung 378, and Fukien 262.

The National Health Administration (Wei Seng Shu) is the central health organization under the jurisdiction of the Administrative Yuan of the National Government and is in charge of the health affairs of the entire country. In the provinces there are provincial health departments or bureaus which are directly under the provincial governments and cooperate with the National Health Administration. In the large cities the health affairs are administered by the Municipal Health Bureau and in the hsien by the hsien health centers. District health stations are established in the chu and hsiang as the branches of the hsien health centers. Health officers are located in villages. This is the public health system practiced in war-time China. However, the public health administration is still in its preliminary stage although it has been developing at a comparatively rapid rate. According to the National Government Year Book (1943), by October 1942, about two thirds of the hsien in Free China have already established their hsien health centers. The number of these centers increased from 43 in 1934, to 217 in 1937, and 783 in 1941.

Since 1939, along the main highways in the northwestern and southwestern provinces, the government has installed the highway health station system. Up to 1942, 41 stations were established. A special health bureau was established for the Yunnan-Burma Highway which administers 16 health stations and 14 circular medical units.

There are no reliable statistics regarding medical schools, hospitals and medical personnel of the entire country since the beginning of the Sino-Japanese hostilities, although recent information for western China is available. Since the emphasis in this manual is on the coastal provinces the earlier data which include the occupied provinces are more applicable. The Chinese Year Book prepared from official sources by the Council of International Affairs, reports for 1936, 26 medical colleges, 2 dental schools, 3 pharmacy schools, 22 schools of midwifery and 35 schools of nursing distributed in 17 provinces and lists 229 missionary hospitals with 16,276 beds in 19 provinces for the same year. The Shin Pao Year Book (1935) gives a total of 426 hospitals with 27,553 beds for 1933. Table 2 contains a compilation of medical personnel in different cities, taken from the "Statistical Abstract of the Republic of China", 1935. Chu and Lai (1935) classified the modern-trained physicians in China as reported in Table 3.

The National Government Year Book (1943) compiled by the Administrative Yuan showed a total registration for 1942 of 11,850 physicians, 794 pharmacists, 322 dentists, 5,770 nurses, 4,971 midwives, and 3,983 druggists.

The sanitary conditions in China are in general very poor. Drinking water which is drawn either from wells or from rivers furnishes ample opportunity for the spreading of the enteric diseases. The disposition of the nightsoil and the use of fecal material as fertilizer is one of the main factors in the prevalence of parasitic diseases. Flood and famine and the crowding of people under abnormal conditions only increase the severity and extent of the epidemics.

From the foregoing statistics, though very fragmentary, it is easily concluded that China has not as yet widely embraced the modern medical practice. Even in large cities the old style practitioners still flourish. Statistics on disease incidence exist only in a few municipalities or in the records of hospitals. Even in the few municipalities recording statistics only a portion of the infectious and other diseases are recorded, as no compulsory notification exists. The only source of morbidity statistics with any reliability is found in the case records of hospitals scattered throughout the country. These statistics tend to show lower morbidity rates and higher case fatality rates than actually exist, due to the fact that many people prefer to consult old-style practitioners and do not come to the hospitals until they are very ill.

TABLE 2

HOSPITALS AND MEDICAL WORKERS IN DIFFERENT CITIES IN CHINA, 1933

City	Physicians	Chinese Herbalist	Pharma-cist	Mid-wife	Old fashion midwife	Hospi-tal	No. of beds	Drug store	Chinese drugstore
Nanking	213	345	54	52	73	45	747	44	115
Shanghai	473	4,780	128	278	--	31	1,967	52	29
Peiping	230	886	526	64	130	17	1,587	67	245
Tsingtao	64	191	12	10	--	17	534	35	221
Weihaiwei	4	23	1	2	22	2	50	--	34
Hangchow	190	261	119	41	42	40	1,325	38	143
Canton	909	1,972	97	1747	--	21	1,981	79	598
Swatow	44	306	1	37	--	8	555	36	98
Kweiyang	30	137	16	10	20	7	103	3	53
Changsha	66	274	115	21	46	16	400	25	182
Nanchang	59	247	30	17	36	26	500	31	75
Hankow	160	588	302	36	75	29	592	80	166
Lanchow	35	35	61	4	19	10	74	10	31
Tsinan	47	236	10	12	4	23	662	52	317
Tientsin	138	837	22	20	34	57	414	62	334
Chenkiang	44	103	42	17	11	21	267	11	31
Anking	33	115	15	4	9	15	226	12	47
Minhou	131	344	81	34	34	41	1,004	54	155
Yungning	12	79	37	16	2	4	126	16	58
Wuchow	30	101	5	18	--	3	280	13	42
Kunming	23	183	20	5	64	6	410	21	100
Wuchang	71	234	183	20	42	6	434	20	99
Sining	8	12	2	1	2	3	22	--	24
Changan	32	64	43	6	7	12	263	10	78
Yangch'u	58	61	102	14	9	29	448	21	65
Kaifeng	87	131	127	12	32	43	419	15	83
Wanchuan	31	73	22	17	15	12	117	7	33
Kweisui	9	33	--	--	13	9	163	8	26

TABLE 3

DISTRIBUTION OF MODERN-TRAINED PHYSICIANS IN CERTAIN LARGE CITIES OF CHINA*

City	Chinese		Foreign	Total	Pop. per Physician	Number of Physicians per 1,000,000 population
	Native trained	Foreign trained				
Shanghai	710	208	264	1,182	3,010	332.2
Nanking	220	48	7	275	3,283	304.6
Mukden	198	13	5	216	4,119	242.8
Peiping	151	69	32	252	4,854	206.4
Harbin	39	1		40	5,421	184.5
Amoy	29	29	5	63	7,509	133.2
Hangchow	100	29	7	136	8,353	119.7
Tsingtao	35	6	29	70	8,469	118.1
Tsinan	42	6	20	68	9,745	102.6
Canton	270	13	19	302	10,453	95.7
Hongkong	64	10	10	84	10,453	93.2
Soochow	45	28	4	77	11,244	88.9
Swatow	33	10	11	54	11,994	83.4
Tientsin	40	22	21	83	15,067	66.4
Wuhan	51	25	28	104	18,773	53.4
Ningpo	34	1	4	39	26,704	37.4
Foochow	12	13	14	39	38,683	25.9
Changsha	10	1	6	17	73,120	13.7

* Chu and Lai (1935)

CHAPTER I

MALARIA

Malaria as one of the most widespread diseases in China constitutes a most serious public health problem and will be a constant hazard to the health of naval personnel. It is endemic throughout coastal China, as well as in the interior, with increasing incidence from north to south. It is endemic as far north as Heilungkiang, and intensely endemic along all of the Yangtze Valley, the southern coastal provinces, and in the regions of the south adjacent to Tonkin and Burma. A survey of 25 hospitals throughout China in 1934 showed that 1.6 percent of the admissions were malaria cases. The percentage of malaria admissions were higher in the Yangtze Valley and in south China (Gear, 1936).

Vivax-malaria occurs in all parts of China and is the predominant or only type in all parts of north China, as well as in central and south China where malaria is not epidemic. *Falciparum*-malaria is limited to central and south China although occasional cases have been reported as far north as Kaifeng. The prevalence of this type increases from north to south; it is predominant in the epidemic and hyperendemic zones. As in other parts of the world, *malariae*-malaria is sporadic in its distribution and is the rarest of the three although it has been reported from all parts of China. Faust (1926) stated that it occurs as far north as Harbin. *Plasmodium ovale* may also occur in China since Yao and Wu (1941) reported the observation of a parasite similar to *ovale* in the blood smears from a case in Kunming. Further details on the distribution of the malarial parasites in China are given in the section discussing the general distribution of malaria in China.

There are probably seven malaria vectors of importance in China. These are *Anopheles hyrcanus sinensis*, a stagnant-water breeder and the most common anopheline throughout the plains of China; *Anopheles labranchiae atroparvus* which has been reported once by Feng (1938) from northern Manchuria; *Anopheles pattoni*, a stream-and pool-breeder, which occurs in the hilly regions of north China; *Anopheles minimus*, a very dangerous stream breeder in the hilly regions of southern China; *Anopheles jeyporiensis candidiensis*, also a stream and irrigation-ditch breeder in the hilly country of south China; *Anopheles culicifacies*, known only from the high plateau of Yunnan Province where it is doubtlessly a vector of some importance; and *Anopheles sacharovi*, thought to be the vector in Sinkiang Province. It is important to note that there is no brackish-water malaria vector in China. *Anopheles sundaicus* occurs no further north than southern French Indochina and *Anopheles subpictus* which occasionally breeds in brackish water in southern China is of no importance in the transmission of malaria in China. Further details on the transmission of malaria are to be found in the section on malaria vectors in this chapter and in Appendix B.

Although malaria has been known in China for centuries it is only in recent decades that it has been subjected to careful scientific investigation and consequently the available information is still very fragmentary.

Faust (1926), using information obtained from various hospitals as well as previously published reports, first summarized the distribution, types, vectors, and climatological relationships of malaria in China. Wei Sheng Shu (1932) made a survey of the disease in the Yangtze valley and Gear (1936) compiled hospital reports on malaria from different parts of China. Hsu and Ke (1937) in their investigations of 19 communicable diseases in China found that malaria accounted for 50.2 percent of all cases, by far the greatest percentage of the 19 diseases studied. King (1943) recorded 451,431 cases of malaria from the free parts of China for 1941; this was more than twice the number of cases of the other ten reportable diseases combined. The knowledge of the malaria-transmitting mosquitoes is best summarized by Feng (1935, 1937, 1938). The large amount of investigation accomplished in western China in recent years has only general application to the region primarily covered by this manual.

GENERAL NOTES ON MALARIA IN CHINA

The purpose of this section is to summarize the available published material in the various parts of China with particular emphasis on the coastal provinces. It is readily apparent that this information is fragmentary, a point to consider constantly in using it. It is not intended that this section give an accurate picture of the entire malaria situation; such is impossible at the present time. Rather, these notes should be regarded as descriptions of the types of malaria situations that may be encountered in China.

In general malaria is not as serious a problem in north China as it is in central and south China. It rarely occurs epidemically and almost all of the cases are due to *vivax*. Nevertheless, as far north as northern MANCHURIA, Taylor (1936) recorded 147 cases treated in the Mukden Hospital from 1929 to 1933 as well as two cases of autochthonous *falciparum*-malaria. He stated that malaria was definitely a menace to the health of certain communities in south MANCHURIA. Jettmar (1932) pointed out that there are two foci of malaria in northern MANCHURIA, one between Lahasusu and Gaidikaudza at the lower end of the Sungari River and the other, a small swampy area between Aigun and Nunkiang (Mergen). Only *vivax*-malaria is known to occur in these foci.

In Chengfu, a village about four miles northwest of Peiping (HOPEI PROVINCE), Lee and Meleney (1927, 1928) examined 260 apparently healthy children and young adults and found a spleen rate of 10.4 percent, excluding splenomegaly due to kala-azar. They reported that in this region malaria increased gradually in February, March, and April, more rapidly in May and June, and reached its maximum in August. Five to seven percent of the population of the village were reported to have had the disease during the malaria season. Only *vivax*-malaria was encountered. For other parts of HOPEI PROVINCE, Gear (1936) reported that 3.3 percent of the hospital admissions in Tientsin and 1.5 percent in Paotingfu in 1934 were due to malaria. One case of *malariae*- and one case of *falciparum*-malaria were found in the Paotingfu series.

In Tsinan, SHANTUNG PROVINCE, apparently only *vivax*-malaria is endemic. The cases of *falciparum* and *malariae* infections have, without exceptions, been among soldiers from the south. Hindle and Feng (1929) reported that in 260,928 routine examinations of out-patients from 1920 to 1926 only 197 cases (0.08 percent) of malaria were detected. Malaria exists throughout the year but the majority of the cases are reported between July and November. Gear (1936) reported 49 cases of malaria treated in the same hospital in 1934. This was 0.7 percent of all hospital cases. The cases were almost entirely *vivax*-malaria. In view of the large number of suitable breeding places for mosquitoes, it is surprising that malaria is not more prevalent in that city. This perhaps may be explained by the presence of larvivorous fish in many of the breeding habitats. Hindle and Feng found that no less than four species were efficient as destroyers of mosquito larvae.

A malaria epidemic in HONAN PROVINCE in 1931 has been described by Johnstone (1934). From the middle of October to the beginning of December there were 76 malaria admissions to the hospital at Kaifeng. There were 35 *vivax* cases, 8 *falciparum*, and 2 *malariae*. Although *vivax* was largely responsible for the epidemic around Kaifeng, *falciparum* is more common in the southern part of the province. An epidemic of *falciparum*-malaria was rumored as plague but was shown by Jettmar (1932) to be malaria. The principal factor in the epidemic was the introduction of *falciparum* from the south by returning soldiers. In the fall of 1938 there was a *vivax* epidemic among the refugees in Chengchow. A primary factor in this epidemic was the bombing of the southern bank of the Yellow River near Chengchow, the resulting flood causing many favorable mosquito habitats.

In the northern part of KIANGSU PROVINCE the malaria situation is generally similar to that of north China. Gear (1936) noted that only 0.7 percent of the hospital cases in the Christian Hospital at Hsüchowfu in 1934 were due to malaria. However, the malaria problem in the Yangtze Valley and adjacent areas is much more serious. Malaria is an important disease in the Shanghai area. Lai, Li, and Chang (1935) reported that in Kao-chiao (a rural district on the east side of the Whangpoo River) malaria is reported throughout the year although it is most prevalent during August. Among 31,256 dispensary cases in 1933, 878 (2.8 percent) were clinically diagnosed as malaria; 52.7 percent of 1,453 dispensary patients and 34.8 percent of 600 school children gave histories of malaria. The spleen index for 752 school children was 18.4 percent. Positive blood smears were obtained in 12.1 percent of 2,655 dispensary patients and from 5.2 percent of 1,803 apparently healthy school children. Plasmodia were found in 15.5 percent of 2,308 persons with positive malaria histories and in 2.1 percent of 2,012 with negative histories. All three species of parasites were found: *vivax* 59.9 percent, *malariae* 33.8 percent, and *falciparum* 6.4 percent. Hu (1935) studied the adult density of *Anopheles hyrcanus sinensis* with reference to malaria incidence in 1933 in the same area and reported that there was a close correlation between the increase in *sinensis* and the increase in malaria cases. Mass emergence of *sinensis* began during the latter part of May,

reached a maximum in July and declined in August. The curve for malarial cases started upward in July, reached a maximum in August, and declined in September. A malaria survey in Kao-chiao was made by the Henry Lester Institute in cooperation with the National Medical College and the Public Health Station of Kao-chiao in 1935-1936 (Andrews and Chu, 1937). School children in this city and nearby villages were examined three times each during the three school terms. There were 4.2 percent positive examinations among 7,766. The rate was 8.0 percent in autumn, 3.0 percent in summer, and 1.7 percent in spring. All three species of parasites were encountered; _vivax_ 86.7 percent, _malariae_ 7.4 percent, and _falciparum_ 5.9 percent. House-to-house surveys were made by Su and Huang (1937) in the Chuan-chiao district in the southwestern suburb of Shanghai; 824 families including 3,637 persons were studied. It was found that 32.7 percent had had malaria during the year of 1936. Among 1,211 school children examined, the average spleen index was 29 percent and the parasite index 20 percent; 518 children gave a malaria history for the year. Among the 1,300 patients who visited the "First Health Station" during the year, there were 415 malaria cases.

Sun and Young (1931) described 167 cases treated at the Elizabeth Hospital in Soochow (KIANGSU PROVINCE) in 1930. More than half of the cases were persons from the northern provinces with less resistance to the disease. In a series of 196 cases treated in the same hospital in 1933, Chang et al (1935) reported the following parasite ratio: _falciparum_ 63 percent, _vivax_ 32 percent, and _malariae_ 0.05 percent. Malaria was reported to have been very prevalent during the year, one admission in seven having been for this disease. Furthermore, because of the limited capacity of the hospital, only severe cases were admitted. A survey of the endemicity of malaria in the Yangtze Valley was made by the National Health Administration in 1931 (Wei Sheng Shu, 1932). Six schools were investigated in Soochow. Among 1,274 children the spleen rate was 2.12 percent. This report states that the 1930 report of the Soochow Hospital gave the following parasite ratio: _vivax_ 49.4 percent, _falciparum_ 39.8 percent, and _malariae_ 19.8 percent. It is interesting to note that in Huang-ching, near Soochow, _malariae_-malaria is the prevalent type. In Wusih there were 225 cases of malaria treated during 1936 (Pan, 1937). Fifty-two percent of these were _falciparum_-malaria. The greatest numbers were diagnosed during September and October. However, _vivax_ and _malariae_ cases were observed throughout the year. The _vivax_ peak was in August and _falciparum_-malaria became epidemic in September and October. All three types of malaria are found in Changchow which is located midway on the railroad from Nanking to Shanghai. Yui and Paty (1935) reported the following parasite ratio among 425 cases: _falciparum_ 62.6 percent, _vivax_ 31.7 percent, and _malariae_ 3.1 percent. _Falciparum_ cases were reported from July to January with the maximum incidence in July.

The National Health Administration survey shows that 2.47 percent of the persons examined in the Nanking area had enlarged spleens, 1.95 percent in the city of Nanking, and 5.75 percent in the rural districts. Among 351 blood examinations 40 were found to be infected with _falciparum_, 36 with _vivax_, and two with _malariae_. Yang and Chiang(1934) of the Central Hospital at Nanking reported 250 cases of malaria among approximately 5,000 admissions. The percentage of the different types of the infection were as follows: _falciparum_-malaria 49.6 percent, _vivax_- 43.6 percent; _malariae_-- 0.8 percent, mixed _vivax_ and _falciparum_ 0.4 percent, and undifferentiated 6.0 percent. The same authors (1933) made a field study among a group of 498 laborers in the Chungshan Mausolean district of the northeastern suburb of Nanking in 1931. Of the total examined 355 were found to have malaria and over 80 percent of those infected were primary infections. The spleen index was about 54 percent. Yao and Ling (1934) examined 5,285 school children for spleen and parasite indices and 565 case records from three hospitals in the municipality. _Vivax_ (67 percent of the total positive) was found to be the dominant species in the blood examinations during the spring survey and _vivax_ and _falciparum_ the most prevalent among the hospital records, being 56 and 38 percent respectively.

The seasonal distribution of all types combined in this area showed that the disease is most prevalent in the late summer and autumn. The highest incidence of infection occurred in October, 1930 and in September, 1931. The _falciparum_ infection starts later and subsides more abruptly than _vivax_; when it begins it has a definite epidemic tendency.

A malaria epidemic was reported at Pa-kua-Chou, a small island in the Yangtze River northeast of Nanking in 1934 by the Malaria Laboratory of the Health Experiment Station (1935). One hundred twenty persons, mostly school children were examined and 14 were found to have enlarged spleens, the index being 11.7 percent. One hundred eighty school children were examined at San-ch'a-ho, located south of Hsia-kuan. Ninety-three (50 percent) were found to have malaria, sixteen (9 percent) to have enlarged spleens, and 10 (6 percent) to harbor Plasmodium.

In Hangchow (CHEKIANG PROVINCE) the National Health Administration (1932) investigated five schools, three in the city and two in the rural districts. A total of 766 pupils were examined and 55 (7.2 percent) were found to have enlarged spleens. The percentage of the enlarged spleens was 3.2 for the city and 16.0 for the rural districts, indicating that the disease is more prevalent in rural than in urban districts. The blood examinations of 86 persons showed 34 positive for the parasites; five with vivax, one with malariae and 28 with falciparum. Gear (1936) reported from the questionnaires from two hospitals, in Hangchow for 1934, that the malaria cases represent 1.6 percent of the total hospital cases in one hospital and 3.5 percent in the other. Rose and Wang (1937) reported that malaria cases in Chekiang occur in every month of the year, with the peak from July to November. The relative abundance of the three Plasmodium species is shown in the following data collected from four different localities in the province (Hangchow, Ningpo, Wuhsing and Shaohsing):

Year	P. vivax	P. falciparum	P. malariae
1929	243	42	5
1930	257	23	9
1931	343	30	48
1932	243	74	31
1933	411	184	52
1934	307	106	32
1935	499	528	57

Further inland in the Yangtze Valley (KIANGSI, ANHWEI, HUPEH, HUNAN) the malaria situation is not well known. During the survey made by the National Health Administration in addition to Nanking, Soochow, Hangchow and Wukong, six large cities along the Yangtze River, i.e., Wuhu, Anking, Kiukiang, Nanchang, Hankow and Wuchang, two villages in Anhwei Province,

and three villages in Kiangsi Province were visited. The report concluded that as a whole falciparum-malaria was the most prevalent type of malaria in the Yangtze Valley during the period of investigation although the vivax-malaria may be more common in other seasons. For the hospital incidence of malaria in this region Gear's report (1936) based on the hospital survey in 1934 is tabulated in Table 4.

TABLE 4

HOSPITAL CASES OF MALARIA IN THE YANGTZE VALLEY IN 1934.

Hospital & Locality	Province	NUMBER OF CASES						Percentage of Total Hospital Cases
		vivax	malariae	falciparum	Mixed	Unclassified	Total	
General, Nanchang	Kiangsi	43	7	53	1	224	328	3.4
General, Wuhu	Anhwei	60	7	4	-	100	171	2.8
Christian, Luchowfu	Anhwei	34	30	21	-	187	272	4.4
Methodist, Hankow	Hupeh	51	20	23	1	30	125	2.3
Union, Hankow	Hupeh	12	2	31	-	133	178	1.9
Methodist, Teian	Hupeh	4	5	2	-	123	134	4.8
Methodist, Wusueh	Hupeh	73	69	1	-	3	146	6.2
Bethesda, Siangyang	Hupeh	3	-	-	-	48	51	1.4
Hudson T., Changsha	Hunan	-	-	-	-	22	22	0.4
General, Changte	Hunan	-	-	-	-	67	67	0.9

It is noted from this table that hospital incidence of malaria is rather high in the provinces of ANHWEI, KIANGSI and HUPEH. Faust (1926) stated that perhaps the most dangerous of the many foci of malaria, from the point of view of dispersal of the disease, is that between Wuchang and Yochow along the northern branch of the Hankow-Canton Railway. The majority of the in-patients with malaria in the Church General Hospital at Wuchang and the Dojin Hospital at Hankow come from the villages along this section of the railway. In HUNAN PROVINCE the incidence is comparatively low. According to Pearson (1935) Shaoyang and most other cities of that part of the province were normally quite free from malaria. Only about 30 cases per year were seen and all were allochthonous. However, this situation changed from 1933 to 1935 and cases of falciparum-malaria in returning soldiers and others were treated daily.

Malaria is also prevalent in SZECHWAN PROVINCE. Crook (1939) reported that among the patients of 15 hospitals in the province the incidence of malaria for the years 1934 to 1937 was 4.19 percent for the in-patients, 1.38 percent for the out-patients, and 1.72 percent for all the patients reported. All three types of malaria occur in Szechwan; the ratio among the patients of 10 hospitals was 52.5 percent vivax-malaria, 41 percent falciparum- and 6.5 percent malariae-. Other localities in the province, however, revealed marked variations from this ratio. In Chungking, the war capital of China, malaria became epidemic in the autumn of 1939. Since then it has been epidemic every autumn in the surburbs of the city. Fortunately 85 percent of the cases were vivax-malaria with a low case fatality rate (Yao, 1943).

Along the southeastern coast, heavy endemic centers with all three types of infection are found throughout FUKIEN PROVINCE especially in the rural districts. Wong, Kang and Jarvis (1937) reported an increasing prevalence of malaria in Foochow and its environs. In 1931 there

were 57 malaria cases admitted as in-patients to the Christian Union Hospital; in 1932, 60 cases; in 1933, 55 cases; in 1934, 77 cases and in 1935, 107 cases; the last representing 7.7 percent of all in-patients for that year. The distribution of the types of the infection of the 107 cases in 1935 is as follows: vivax-malaria 16, falciparum- 59, malariae- 4, mixed infection of vivax- and falciparum- 1, undifferentiated 5, and clinical cases with negative smears 22. It is obvious that falciparum-malaria is the predominant type in this area. The incidence reaches its peak in November. Further inland along the Min River, Hemenway (1930) reported one hundred malaria cases at Mintsing and observed that nearly every blood smear in this district showed Plasmodium. Dang, Hemenway and Lau (1935) studied 960 cases of malaria in the same region; of 100 smears made, 74 were found to be vivax, 19 malariae, and 7 falciparum. It is interesting to note that malariae appears to be more common than the falciparum in this series. Fu (1935) described an epidemic at Chiang-lo in the upper valley of the Min River in the western part of the province. It was found that malaria was prevalent every year in Chiang-lo, but especially frequent from July to October. A total of 326 school children from four districts were examined and an average of 16.3 percent were found to have malaria. In one of the four districts 20 percent of the total deaths from July to November, 1934, were due to malaria. Over 90 percent of the soldiers stationed in this locality had malaria during the months of August and September. The data from the above two localities would clearly indicate that the entire Min River Valley is highly endemic. Further south in Amoy, Feng (1932) found that malaria was endemic, especially in the villages near the hills. The monthly distribution of 539 malarial cases treated at the dispensary of the Amoy University during a period of eight years shows that the disease occurs throughout the year with two prevalent seasons, May and October. The incidence in October is much higher. The rise in the malaria curve begins with the rainy season which occurs in late summer and reaches its height about one month after the end of the rainy season. Examinations of positive blood smears from 63 cases revealed that the most common parasite is P. falciparum, (40 out of 63, or about 63 percent). Next is the mixed infection of P. vivax and P. falciparum with a rate of about 19 percent. Simple infection with P. vivax is third; P. malariae is the rarest of all.

Five species of Anopheles were found during the survey in July and August, viz., A. minimus, A. jeyporiensis, A. hyrcanus sinensis, A. splendidus, and A. maculatus. A. minimus is by far the most common species in the season and appears to be the most important natural carrier for malaria in Amoy, although in other seasons A. hyrcanus sinensis and A. maculatus may be suspected to be vectors. Gear (1936) reported that 3.4 percent of the total hospital cases in Hope Hospital on Kulangsu Island were malaria cases and the most of them were falciparum infections.

In KWANTUNG PROVINCE Gear (1936) reported that in 1934 malaria cases were 0.4 percent of the total hospital cases of the Mission Hospital at Swatow, and 4.1 percent of those of the Canton Hospital. The seasonal malaria incidence in Canton and Hongkong is similar to that of Amoy. There are two prevalent seasons; one in late spring, and the other in the fall or early winter. Cadbury (1935, 1938) studied the seasonal incidence of the disease on Honan Island near Canton from 1928 to 1931, and found that there were two peaks each year, one occurring between September and January and the other in May. The maximum corresponds in general with the so-called dry season. With the onset of the cold weather in January and February the disease is checked even before the rains begin. He also studied 347 Lingnan University students and staff members and 1,891 workmen and villagers; of the infected students and staff members 86 percent showed P. vivax and 13 percent P. falciparum. Most of the cases became infected in the autumn and early winter. Among the villagers the incidence was 72 percent for P. vivax, and 24.1 percent for P. falciparum, and 2 percent for P. malariae. Here again most cases occurred in the fall.

Cadbury (1935) stated that, early in 1928, Given made some interesting observations on the seasonal prevalence of malaria in Hongkong (KWANTUNG PROVINCE) and reported that the bulk of malaria occurring among the military forces is transmitted by a dry-season (last three months of the year) malaria carrier e.g., A. maculatus Theobald or A. minimus Theobald, and that the incidence among police employed in the populous areas of Kowloon, where many varieties of mosquitoes are prevalent, occurs in both the wet and dry seasons. Jackson (1935) reported that of 295,477 patients treated in various dispensaries in Hongkong and Kowloon 8,524 (2.9 percent) were for malaria and of 46,100 hospital admissions 1,672 (3.6 percent) were due to malaria. He also recorded that out of 1,181 factory workers examined in Chin-lung 951 had malaria and 526 of these harbored Plasmodium. The distribution of the species is as

follows: P. falciparum 72 percent; P. vivax 27 percent, and P. malariae 1 percent. The same author (1936) examined 3,733 thick blood films taken from the prisoners admitted daily to Victoria Goal during 1933-1935 and discovered 63, (1 percent) positive for malarial parasites. In Ho-yuan at the bank of the East River in the eastern part of the province, Boeckh (1925) reported that vivax-malaria was practically the only type until 1923 when, because of the introduction of infected troops from Yunnan, an epidemic of falciparum-malaria was also encountered. Of a population of 10,000 in the environs of the city, 700 (besides children) died and more than 5,000 suffered from the disease. In the northern part of KWANTUNG PROVINCE and southern part of HUNAN PROVINCE, Liu (1935) reported that malaria was the principal disease among the railroad workers. Of the 1,764 blood examinations made 246 (13.9 percent) were positive for malarial parasites. Of these positive cases 74.4 percent had P. vivax; 25.2 percent had P. falciparum, and 0.4 percent had P. malariae. The average spleen rate was 39.7 percent.

Malaria is prevalent throughout HAINAN ISLAND and especially severe in the mountains in the center of the island. Both P. vivax and P. falciparum are frequently found in the blood of the patients. Burkwall (1943) stated that over 11,000 cases of malaria were reported from Hainan in 1925-1941. Tanaka (1941) examined 211 persons for malaria in Yulin district on the southern coast of the island and found 13 of them were infected with the parasites. Of the positive cases, five harbored P. vivax; seven, P. falciparum and one had both species. No P. malariae was found.

Malaria is very prevalent in the south western provinces of China (KWANGSI, KWEICHOW, and YUNNAN). The disease known as "changchi" has been known and feared by the people in this region since three centuries B.C. Scientific investigation of "changchi" both clinically and microscopically has proved the disease is falciparum-malaria (Yao, 1936, Yao and Ling, 1936).

Feng (1936, 1937) studied the malaria problem in KWANGSI PROVINCE and reported that it varied from hyperendemism in some localities to complete absence in other localities in the province. As a whole the mountainous regions in the peripheral parts are more endemic than the less hilly areas in the flat districts of the central part of the province. In Lung-sheng-hsien, one of the hyperendemic areas on the northern border of the province, among 119 children examined 69 had enlarged spleens and 59 harbored parasites, a spleen index of 58 percent and parasite index of 50 percent. Of the parasites found 62 percent were P. vivax; 38 percent were P. falciparum. At Mo-ma-tsun, about 10 miles east of Tien-yang-hsien, where the disease is epidemic the spleen rate was found to be 60 percent among the children and 48 percent among the adults, while the parasite rate was 85 percent for both children and adults. Of the 292 persons positive for the parasites 172 were infected with P. falciparum, 69 with P. vivax, and 51 with both. Peh-i, Nan-tan, and Wuchow are found to have moderate endemicity while Pin-yang, Ping-lo, and Liu-chow have low endemicity of the disease. The author concluded that a definite relationship seems to exist between the malarial incidence and the population of certain species of the anopheline mosquitoes. In the hilly regions where the numerous small streams form the ideal breeding places for A. minimus and A. jeyporiensis candidiensis, malaria is highly endemic. In the central parts of the province the presence of numerous ponds, rice fields, pools, and marshes, etc., produces usually only large numbers of A. hyrcanus sinensis, and malaria is not common in these places. This indicates that the first two species of mosquitoes are the most important malaria transmitters in this part of the country while the last species is probably of only secondary importance. According to Yao (1943), while the Hengyang-Liuchow Railroad was being constructed in 1938 a great number of the workmen who were engaged in building the section between Yungfu and Lutsai in Kwangsi Province contracted subtertian malaria.

Yao (1936) and Yao and Ling (1936) made investigations of the disease on the border of KWANGSI and KWEICHOW Provinces. A number of children below the age of 12 were examined at several localities. Spleen index was found to range from 21 percent to 66.7 percent, with an average of 35.9 percent. Parasite index ranged from 46.3 percent to 83.3 percent averaging 50.4 percent; 72.9 percent were P. falciparum, indicating that falciparum-malaria is by far the most common type of infection in this region.

In KWEICHOW PROVINCE there are 54 health stations and clinics administered by the Health Commission under the Provincial Government. There is an average monthly attendance of 14,338 patients at the 54 clinics, 15 percent of whom are malaria cases (Kan 1941). In the

autumn of 1938 an epidemic of malaria occurred in Sungtao and Tungyuen on the eastern border of the province due mostly to P. falciparum. A survey for malaria was made by the same author in 14 of the 81 districts (hsien) of the province in 1938. Altogether 5,878 children below the age of 12 were examined and the spleen index was found to be 15.2 percent and the parasite 13.1 percent. Among the districts surveyed Chen-feng showed the highest incidence, the spleen index being 37 percent and parasite index 57 percent and Tsehung second, with a spleen index of 63 percent and parasite index of 42 percent. Both places are situated on the southwestern border of the province, near the Pan River. Yao (1943) reported that from 1938 to 1940 there were severe annual epidemics of malaria in the districts on the HUNAN-KWEICHOW border. There were thousands of deaths in the villages. In the autumn of 1940 H. C. Kan of the National Health Administration made a survey of that part of the country. According to his report, in one village with a population of 800, there were 200 malaria deaths in 1939, and 80 in 1940.

In YUNNAN PROVINCE the malaria situation is better known because of various investigations made in recent years. For centuries falciparum-malaria has been known as "changchi" in Yunnan. This disease is especially prevalent in the southern and western regions of the province near the border of Burma and Indo-China. Most of the endemic areas are in the valleys of the three main rivers, Yuan-kiang, Papien-kiang, and Lan-tsang-kiang (Mekong); there is no malaria in the high mountains. The morbidity and mortality of this disease are much higher than any other disease in these localities. It is estimated that there are over 500,000 malaria cases each year in the province (Williams, 1941). In an interview granted to newspaper reporters in Kunming, Y. K. Liang, of the Sino-British Boundary Commission remarked that in the district of Sze-mao of the southern part of the province, a vast area of land in the country was without cultivation, and 90 percent of the houses in the city were without occupants. The population of the district was reduced from 100,000 to 20,000 by malaria in 14 years starting in 1925. The same condition was found in Ning-er, an adjacent district north of Szemao (Yao, 1939).

Robertson (1940) and Robertson and Chang (1940) conducted malaria surveys in WESTERN YUNNAN. They reported that among 1,392 patients who came to the Lungling Health Center during August, September and October in 1939, 546 (39.2 percent) had malaria. Of 1,412 patients who came to the Southwestern Transportation Bureau Clinic, Mangshih, 1,012 (78.0 percent) were diagnosed as malaria cases from July to October 1939. Out of 4,203 in the Highway Bureau Clinic, Mangshih, during the same period 1,988 (47.3 percent) were malaria cases. Nine hundred sixty-five children from six districts were examined; the spleen index was 17.4 percent and the parasite index was 18.9 percent. Of the species identified 71.8 percent were falciparum; 25.2 percent were vivax; and 3 percent were malariae.

Williams (1941) examined 237 children in Chefang and found that 144 (60.8 percent) of them had enlarged spleens. Thick-film examinations revealed 124 positive cases, representing 52.3 percent. Of those with normal-sized spleens, 12 percent were blood positive. Of the 144 blood positive cases 30 percent were P. vivax, 67 percent were P. falciparum, and 3 percent were mixed infection of both species. The survey was made during the winter season. The author believes that during the rains from June to October the infection rate must be 100 percent. Yu and Ling (1943) observed 107 falciparum cases between October 1939 and September 1940 in Kunming which is removed from the hyperendemic area. The incidence of falciparum-malaria gained its peak in June and July, and remained high in August and September. In October the curve sharply declined.

It should be noted that it is in the city of Kunming that Yao and Wu (1941) reported the possible presence of P. ovale, in four blood smears, taken by the Yunnan Provincial Hygiene Laboratory, from a male patient admitted to the Kun Hua Provincial Hospital on November 5, 1939.

MALARIA VECTORS

The following species have been considered to be important malaria vectors:

A. labranchiae atroparvus (?)	North Manchuria
A. hyrcanus sinensis	In plains throughout China
A. pattoni	Hilly regions of north China
A. minimus	Hilly regions of south China
A. jeyporiensis candidiensis	Hilly regions of south China
A. culicifacies	High plateau of Yunnan Province
A. sacharovi	Sinkiang Province

Four other species have been found naturally infected in south China but are not considered to be of primary importance due to the coexistence of better vectors. They are A. annularis A. maculatus, A. splendidus, and A. tessellatus. The following is a brief account of the distribution, habits, and Plasmodium infectibility of these species. The distribution, is taken mostly from Feng (1938) with the additions from subsequent papers. The results of the dissections of different species performed in China are summarized in Table 5. The entire fauna of China is discussed in Appendix B.

1. Anopheles labranchiae atroparvus van Thiel, 1927.

This mosquito has been reported by Feng from Heiho and Lungchen in northern Heilungkiang Province. Feng's determination was based on his examination of the genitalia of one male specimen and needs further verification. Since malaria is endemic in this area and this atroparvus is an important malaria vector elsewhere it seems to be reasonable to assume that this mosquito is responsible for the transmission of the disease in this region. However, one should bear in mind that A. hyrcanus sinensis has been found in the lower Sungari region, another adjacent endemic area, and that A. messeae a proven malarial vector, is reported to occur along the Amur River country. It is likely that further investigation will prove the presence of both species in both of the endemic areas. Furthermore there is the possibility that Feng's atroparvus may prove to be another member of the maculipennis group. The larvae of atroparvus breed in ditches containing fresh water as well as in brackish water along coastal areas. Adult females have been taken from human dwellings. They readily feed on man and domestic animals. According to Feng and Chin (1937), the records of A. maculipennis from Chinwangtao by Faust and from Kirin by Li are erroneous.

2. Anopheles hyrcanus sinensis Wiedemann, 1928.

This mosquito is the most widespread anopheline in China. It has been recorded from the following provinces: Anhwei, Chekiang, Fukien, Heilungkiang, Hopei, Hunan, Hupeh, Kiangsi, Kiangsu, Kirin, Kwangsi, Kwangtung, Kweichow, Liaoning, Shansi, Shantung, Szechwan, and Yunnan. The larvae are found in grass-covered stagnant water, such as swamps, drying rivers or streams, lakes, ponds, marshes, ditches, pools, rice fields, drains, large open wells, and stagnant or slowly running water along the shores of streams, rivers, or lakes. They are also found occasionally in water in artificial containers. The adult females enter houses and attack man as well as domestic animals. There is a diversity of opinion regarding the feeding habits of this mosquito (Appendix B). Apparently it is primarily zoophilic and attacks man only in the absence of other mammals, despite the fact that in some regions it appears to be a common domestic mosquito. This agrees with the fact that despite its fairly high experimental rate, its rate of natural infection is relatively low (Table 5). In general, this species, despite its being most numerous and most widely spread in this country, epidemiologically plays only a minor role in the transmission of malaria in China. Its importance is second to A. pattoni in the north, second to both A. minimus and A. jeyporiensis candidiensis in the south. Nevertheless, it is always a potential vector and doubtless of local importance in many areas.

3. Anopheles pattoni Christophers, 1926.

This is mainly a northern species. It has been found in the hilly regions of the following provinces: Hopei, Shantung, and Szechwan. Larvae are found chiefly in slowly running, hilly streams, in pockets of water along borders of streams; in rain pools and pools of river beds with sandy bottoms. They have been found to hibernate under ice in winter. The adult female bites man as well as domestic animals. Hindle and Feng (1929) experimentally infected nine out of eleven specimens with P. vivax in Tsinan and proved its being a more favorable host

of the parasite than A. hyrcanus sinensis in that region. Natural infection of this species has not been observed.

4. Anopheles minimus Theobald, 1901.

This is primarily a southern species and has been recorded in the following provinces: Chekiang, Fukien, Hunan, Kiangsi, Kwangsi, Kwangtung (including Hainan Island), Kweichow, Szechwan and Yunnan. The larvae occur chiefly in clear slow-running hilly streams, river margins, and springs with grassy edges, flowing drains and canals. Irrigation ditches leading from streams in the hills of south China are often found with large numbers of these larvae. Adults are commonly found in large numbers in houses and cattle sheds in those regions. They bite man freely during the night and remain indoors after biting. Feng, (1932) found that it was most numerous in July and August. Chang (1941) reported that this species appeared to be most abundant at the time when the incidence of malaria was increasing in Yunnan. This species has a high rate of natural infection in China (Table 5) and is the most important vector wherever it occurs. Summing the results of the various investigators, 23,280 specimens of this species have been dissected; infection rates, varied from 0 to 30 percent with an average of 5.5 percent. On the whole it is to be considered the most important transmittor of malaria in China.

5. Anopheles jeyporiensis candidiensis Koidzumi, 1924.

This is also a southern mosquito with habits similar to that of minimus. It has been reported to occur in the following provinces: Chekiang, Fukien, Kwangsi, Kwangtung, (including Hainan Island), and Yunnan. The larvae breed in slowly running water, such as river margins, grassy shallow streams, or irrigation ditches formed from seepage water draining from the sides of hills. They have been found in abandoned and flooded rice fields in the foothills. The adult females bite man freely. This species is also considred to be an important malaria vector in the hilly regions of south China; it has a high natural infection rate (Table 5). For example, Jackson dissected altogether 15,324 specimens in the Hongkong area in 1934 to 1936 and found 1,221 being infected, averaging 8 percent. The species next to A. minimus is considered to be the important vector of malaria in the southwestern part of China.

6. Anopheles culicifacies Giles, 1901.

This species has thus far been found in China only from the high plateaus of Yunnan Province. The larvae breed in streams, irrigation canals, irrigation pools, and over-flow water collections. Outside China they have been observed in a wide variety of breeding places of fresh clean water, such as irrigation channels, rocky or sandy pools, river beds, rice fields, and occasionally in brackish water. The adult females attack man freely at night and rest in houses and cattle sheds in the daytime. Gaschen (1935) found this species naturally infected at Lahati of Yunnan. Robertson (1940) found two (3.8 percent) of 52 specimens of this species caught at random in houses in Mangshih positive for plasmodia. In China this species is considered as an important malaria vector on the high plateaus of Yunnan Province where it occurs in great numbers; it is the most important vector in India and Ceylon.

7. Anopheles sacharovi Favr, 1903.

This species has been reported in the Chinese territory only from Kashgar of Sinkiang Province, where all the three types of malaria were reported to be present (Chtcherbakoff, 1930). Its breeding habits have not been observed in China. In Europe and Central Asia larvae commonly occur in shallow standing water open to sunlight in midsummer. They are found in fresh as well as brackish water. The adult females enter houses and freely bite man as well as domestic animals. It is important as a malaria vector in the Balkans and Palestine and is considered to be a natural carrier in Kashgar. The occurrence of this species in China is based on a single collection; further study and verification both of its presence and role in malaria transmission are needed.

8. Anopheles annularis van der Wulp, 1884.

This species has been recorded in Kwangsi, Kwangtung and Yunnan Provinces. The larvae breed in stagnant water as well as in slowly running water. They have been collected in hilly streams, rivers, ditches, pools, ponds, rice fields, etc., especially in water with grassy vegetation.

The adult females suck human blood vigorously but feed upon cattle by preference. Robertson (1940) found 1.6 percent of this species, collected at random in houses in Mangshih in Yunnan, infected with malaria parasites. Chang (1941) dissected 15 specimens of this species caught from bedrooms of a malaria infected family and found six of them infected. However, the author considered this mosquito as ranking with A. hyrcanus sinensis, a malaria vector of minor importance although it is a common species in this region.

9. Anopheles maculatus Theobald, 1901.

This species is more widely spread than annularis and has been recorded from the following provinces: Fukien, Hunan, Kiangsi, Kiangsu, Kwangsi, Kwangtung, (including Hainan Island), Kweichow, Yunnan. The larvae breed in water in connection with rocks, sand, and seepages, such as pools in rocky streams, or in sandy river beds, springs, and spring-fed pools, river margins with grass, rice fields and irrigation ditches. The adult females attack both man and domestic animals freely. The species has been reported to be an important malaria vector in Malaya and the Netherlands Indies. In China, Jackson (1935) reported that 3.5 percent of 230 specimens collected from the epidemic area in Kowloon were infected with malarial parasites. An experimental infection rate of 63.6 percent was reported by the same author at Hongkong (1936). Robertson (1940) included this species as one of the six species definitely proven as malaria vectors at Mangshih, Yunnan, and reported a natural infection of 7.1 percent compared to minimus with 9.8 percent. Chang (1941) also accused this species of being responsible for the transmission of malaria but regarded it not as important a vector as minimus, except perhaps, during the dry season in Mangshih.

10. Anopheles splendidus Koidzumi, 1920.

This species has been collected from China in the following provinces: Fukien, Kwangsi, Kwangtung (including Hainan Island), and Yunnan. Larvae breed in pools and river beds with sandy bottoms and in water puddles along the streams. They have also been found in earthenware jars containing rain water in open fields. The adult females enter houses and suck human blood. Jackson (1935) dissected 27 specimens collected in the epidemic area of Kowloon and found two infected with malaria parasites. Since this is a comparatively rare species in China, it is considered of no practical importance in the transmission of malaria.

11. Anopheles tessellatus Theobald, 1901.

This species has been collected from Kwangtung Province in Canton, Swatow, Hongkong and Hainan Island, and Yunnan Province from Mangshih, and Chefang.

The larvae breed in rice fields, irrigation ditches, and swamps. Adult females occur frequently along stream banks but have also been taken in human dwellings. They seem to prefer the blood of cattle. Jackson (1936) found one out of 40 specimens of this species collected in Hongkong to be naturally infected with Plasmodium. It has also been found naturally infected in the Netherlands Indies and French Indochina, but is not considered to be an important vector of malaria.

BLACKWATER FEVER

In spite of the prevalence of malaria in China, blackwater fever is comparatively rare. Maxwell (1929) included the southern valleys of Yunnan bordering on Siam as an area where the disease frequently occurs and added that individual cases have been reported from Hankow in foreigners, and from Yungchun in Fukien and Swatow, Kietyang and Hainan Island of Kwangtung. Further he quoted Wenyon as saying that the disease ravaged like a plague in the Chinese army on the Tonkin border of Kwangsi.

Tunnell (1943) in reporting two cases, stated that blackwater fever is extremely rare in south Fukien. One of the cases reported was from Hweian and the other from Chuanchow. Chiu (1939) reported one case from Kowloon Peninsula. Hua and Cheng (1940) reported two cases among the immigrants to the New Territories and Lui (1941) added another case, a student from the same locality. This disease seems more common in Hainan Island. Seaton (1935) reported that since 1932, several cases have come each year to the Mary Henry Hospital, Nodoa, Hainan Island. They have all come from the market town of Mamfong, eight miles from Nodoa, and from one of its outlying villages, Lokngna, two miles further south. All the patients gave a history of frequent malaria attacks. Malaria is prevalent throughout the island. Cases of blackwater fever

were recorded among the more permanent residents. Burkwall (1943) reported 25 cases of blackwater fever treated in the Mary Henry Hospital since 1935 and 22 treated between June 1940, and February, 1941. All the patients in this series were former residents of Nodoa who had been subject to frequent malaria attacks and were accustomed to taking quinine with each onset of fever or malaise. In Yunnan Province, Chen-Wong (1941) reported three cases of blackwater fever from 41 cases of proven malaria admitted to Kun Hua Provincial Hospital at Kunming 1938.

TABLE 5

RECORDS OF INFECTIONS OF ANOPHELINE MOSQUITOES IN CHINA.

Species	Number Dissected	Number Infected	Percentage Infected	Nature of Infection	Locality	Author and Date
Anopheles hyrcanus sinensis	121	20	16.53	*P. vivax* - experimental	Tsinan, Shantung	Hindle & Feng, 1929
	464	2	0.43	Natural	Woosung, Shanghai	Feng, 1932
	6	1	16.66	Natural	Soochow, Kiangsu	Feng, 1932
	1,200	5	0.41	Natural	Nanking	Khaw & Kan, 1933
	18	4	22.22	Experimental (*P. malariae*)	Nanking	Khaw & Kan, 1933
	6,455	6	0.09	Natural	Nanking	Yao, 1934
	13	3	23.07	Experimental (*P. vivax*)	Nanking	Yao, 1934
	24	0	-	Experimental (*P. falciparum*)	Nanking	Yao, 1934
	13	0	-	Experimental (*P. malariae*)	Nanking	Yao, 1934
	9	0	-	Natural	Amoy	Feng, 1932
	2	0	-	Natural	Amoy	Feng, 1932
	2,818	34	1.20	Natural	Kowloon	Jackson, 1934
	176	0	-	Natural	Kowloon	Jackson, 1934
	383	1	0.26	Natural	Hongkong	Jackson, 1936
	672	0	-	Natural	Canton	Wu, 1935
	15	1	7.00	Natural	Lungsheng, Kwangsi	Feng, 1936
	74	0	-	Natural	Enyang, Kwangsi	Feng, 1936
	2	1	50.00	Experimental	Mokiang, Yunnan	Ling, Liu & Yao, 1936
	2	0	-	Natural	Szemao, Yunnan	Ling, Liu & Yao, 1936
	1,695	1	0.06	Natural	Mangshih, Yunnan	Yao, 1940
	4,051	0	-	Natural	Chefang, Yunnan	Sweet, 1940

TABLE 5 (Cont'd)

Species	Number Dissected	Number Infected	Percentage Infected	Nature of Infection	Locality	Author & Date
(Cont'd) A. hyrcanus sinensis	873	8	0.92	Natural	Chungking, Szechwen	Kan, 1941
	5,531	2	0.04	Natural	Tsingchen, Kweichow	Kan, 1940
	232	8	3.45	Natural	Mangshih, Yunnan	Robertson, 1940
	16	5		Natural	Mangshih, Yunnan	Chang, 1941
	101	6	5.94	Natural	Pehpei, Szechwan	Tan, 1943
Anopheles minimus	201.	60	29.85))12.2)	Natural	Amoy (Epidemic)	Feng, 1932
	50	2	4.00)	Natural	Amoy (Endemic)	Feng, 1932
	2,155	269	12.48	Natural	Kowloon (Epidemic)	Jackson, 1934
	1,185	43	3.63	Natural	Kowloon (Endemic)	Jackson, 1934
	3,259	178	5.46	Natural	Little Hongkong	Jackson, 1935
	1,147	514	4.49 (?)	Natural	Little Hongkong	Jackson, 1936
	712	21	2.90	Natural	Canton	Wu, 1935
	37	6	16.00	Natural	Lungsheng, Kwangsi	Feng, 1936
	1	0	-	Natural	Enyang, Kwangsi	Feng, 1936
	55	3	5.40	Natural	Sze-mao, Yunnan	Ling, Liu & Yao, 1936
	5,583	195	3.3	Natural	Mangshih, Yunnan	Yao, 1940
	12,326	123	1.00	Natural	Chefang, Yunnan	Sweet, 1940
	154	0	0	Natural	Chungking, Szechwan	Kan, 1941
	316	31	9.81	Natural	Mangshih, Yunnan	Robertson, 1940
	11	8		Natural	Mangshih, Yunnan	Chang, 1941

TABLE 5 (Cont'd)

Species	Number Dissected	Number Infected	Percentage Infected	Nature of Infection	Locality	Author & Date
Anopheles jeyporiensis candidiensis	28	1	3.57	Natural	Amoy (Epidemic)	Feng, 1932
	6	0	-	Natural	Amoy (Endemic)	Feng, 1932
	10,936	1,086	9.93	Natural	Kowloon (Epidemic)	Jackson, 1934
	3,707	119	3.21	Natural	Kowloon (Endemic)	Jackson, 1934
	137	3	2.18	Natural	Little Hongkong	Jackson, 1935
	544	13	3.31	Natural	Little Hongkong	Jackson, 1936
	91	0	0	Natural	Canton	Wu, 1935
	56	2	4.00	Natural	Lungsheng, Kwangsi	Feng, 1936
	1	0	0	Natural	Enyang, Kwangsi	Feng, 1936
	53	1	1.80	Natural	Sze-mao, Yunnan	Ling, Liu, & Yao, 1936
	1,363	3	0.2	Natural	Mangshih, Yunnan	Yao, 1940
	101	6	5.94	Natural	Mangshih, Yunnan	Robertson, 1940
	1	1		Natural	Mangshih, Yunnan	Chang, 1941
Anopheles maculatus	230	8	3.48	Natural	Kowloon, (Epidemic)	Jackson, 1934
	187	0	0	Natural	Kowloon (Endemic)	Jackson, 1934
	129	0	0	Natural	Little Hongkong	Jackson, 1935
	477	0	0	Natural	Little Hongkong	Jackson, 1936
	22	14	63.63	Experimental	Pokfulam, Kwangtung	Jackson, 1936
	42	3	7.14	Natural	Mangshih, Yunnan	Robertson, 1940
	3	1		Natural	Mangshih, Yunnan	Chang, 1941

TABLE 5 (Cont'd)

Species	Number Dissected	Number Infected	Percentage Infected	Nature of Infection	Locality	Author & Date
Anopheles splendidus	27	2	7.40	Natural	Kowloon (Epidemic)	Jackson, 1935
	4	0	0	Natural	Kowloon (Endemic)	Jackson, 1935
Anopheles karwari	1	0	0	Natural	Kowloon (Epidemic)	Jackson, 1935
	1	0	0	Natural	Little Hongkong	Jackson, 1936
A. pattoni	11	9	81.81	Experimental (P. vivax)	Tsinan, Shantung	Hindle & Feng 1929
A. tessellatus	40	1	2.50	Natural	Little Hongkong	Jackson, 1936
A. culicifacies	?	1	?	Natural	Yunnan	Gaschen, 1935
	52	2	3.84	Natural	Mangshih, Yunnan	Robertson, 1940
A. vagus	1	0	0	Natural	Szemao, Yunnan	Ling, Liu & Yao, 1936
	37	0	0	Natural	Mangshih, Yunnan	Robertson, 1940
A. annularis	380	6	1.57	Natural	Mangshih, Yunnan	Robertson, 1940
	15	6		Natural	Mangshih, Yunnan	Chang, 1941
Anopheles hyrcanus nigerrimus	9	0	0	Natural	Mangshih, Yunnan	Robertson, 1940
Anopheles barbirostris	3	0	0	Natural	Mangshih, Yunnan	Robertson, 1940

TABLE 6

SUMMARY OF MALARIA IN THE COASTAL PROVINCES

Province	General Incidence	Predominant Type	Prevalent Season	Vectors
Liaoning	Endemic	vivax		hyrcanus sinensis
Hopei	Endemic	vivax	May - October	hyrcanus sinensis, pattoni
Shantung	Endemic	vivax	July - November	hyrcanus sinensis, pattoni
Kiangsu				
Northern Part	Endemic	vivax		hyrcanus sinensis
Southern Part	Endemic and occasionally epidemic	vivax and falciparum	Summer and autumn (especially September and October)	hyrcanus sinensis
Chekiang	Endemic and occasionally epidemic	falciparum and vivax	July - November	minimus, hyrcanus sinensis, jeyporiensis candidiensis
Fukien	Endemic and occasionally epidemic	falciparum and vivax	May - November (peaks in May and October)	minimus, maculatus, jeyporiensis candidiensis, hyrcanus sinensis
Kwangtung	Endemic and epidemic	falciparum and vivax	Late spring and late autumn	minimus, hyrcanus sinensis, maculatus, jeyporiensis candidiensis
Hainan Island	Endemic and epidemic	falciparum and vivax	Probably the same as in the mainland of Kwangtung	minimus, maculatus, jeyporiensis candidiensis, hyrcanus sinensis

CHAPTER II

FILARIASIS

Filariasis and elephantiasis are fairly common in China especially in the coastal provinces. The endemic area encompasses a belt somewhat more than fifty miles wide along the coast from the southern boundary to Shantung Province. Hainan Island is also endemic. In the Yangtze Valley and likewise in the West River Valley the endemic area extends far inland. There is also an isolated endemic area in Szechwan Province. Wuchereria bancrofti is the common filarial parasite and apparently occurs throughout the endemic area. The distribution of Wuchereria malayi is more restricted. However, since this species was not observed until recently (Feng, 1933), it is possible that it has a wider range than is known at the present time. More precise details on distribution of both species are contained in subsequent paragraphs. In so far as is known, the periodicity of the microfilariae is nocturnal; the vectors, such as Culex quinquefasciatus and Anopheles hyrcanus sinensis, are nocturnal in their feeding habits.

Incidence and distribution of filariasis in China. -- Generally speaking, filariasis in China occurs in the lowlands; especially along the coast, on islands, and on the banks of the large rivers and lakes of the tropical and subtropical regions. In the highlands of the interior it is extremely rare or absent. Thus the infection prevails in the coastal provinces, from SHANTUNG PROVINCE in the north to KWANGTUNG PROVINCE in the south, the provinces in the Yangtze Valley and the regions near the large lakes in HUNAN PROVINCE and HUPEH PROVINCE. Sporadic cases have been reported as far north as MANCHURIA and as far west as SZECHWAN.

In KIANGSU PROVINCE, Jefferys and Maxwell (1911) stated that elephantiasis is said to be abundant in Chenkiang and Soochow and present in Yangchow, Nanking, and Shanghai. Lee (1926) examined 314 individuals from northern KIANGSU PROVINCE for the presence of microfilariae and reported that seven of 119 from Hsüchowfu and 31 of 195 from Tsingkiangpu district were found to be infected. Some of the inhabitants from Suining and Szeyang districts between Hsüchowfu and Tsingkiangpu also had microfilariae in their blood. In 1930 Lee again reported a microfilaria index of 21.4 percent in Hsüchowfu district and 15.4 percent in Tsingkiangpu district. Yao, Wu and Sun (1938) conducted a filariasis survey and found that out of 65 persons examined, 16 (24.6 percent) harbored microfilariae. It is therefore safe to assume that filariasis is endemic throughout KIANGSU PROVINCE. Lee also reported a native from SHANTUNG PROVINCE found to have filariasis.

Park (1900) reported 86 cases of elephantiasis from Soochow among 25,000 cases of all kinds in three years. In the Paoshan district north of Shanghai, Hu (1934) reported that of the 146 prisoners examined, 27 (18.5 percent) had microfilariae of W. bancrofti at the time of examination. Of the 27 positive cases, 17 were natives of Paoshan district. Most of the others were from various towns in the KIANGSU PROVINCE.

Elephantiasis is well known among the inhabitants of the Woosung district of Shanghai. Feng (1931) stated that nine percent of the dwellings in Woosung town and 33 percent of the dwellings in the villages harbored mosquitoes with larvae of Wuchereria bancrofti. In this district there are five species of mosquitoes commonly found in dwellings, namely, Anopheles hyrcanus sinensis, Culex tritaeniorhynchus, Culex pipiens pallens, Aëdes albopictus, and Armigeres subalbatus (obturbans of Hu). All five species are found to enter houses and bite human beings. A. hyrcanus sinensis occurs mostly in the small village dwellings and C. pipiens pallens is common in the town of Woosung. Feng also reported that eleven percent of A. hyrcanus sinensis caught wild were infected with filarial larvae and 16 percent of the infected specimens contained mature larvae. About 13 percent of C. pipiens pallens caught in nature harbored filarial larvae but none were infective. Filarial larvae in early stages of development have also been observed in the other three species under natural conditions. Feng (1930) suggested that A. hyrcanus sinensis is the natural disseminator of filariasis bancrofti in Woosung. Since it has also been found naturally infected in Soochow, it is probable that it is the intermediate host of W. bancrofti throughout the Yangtze Valley. Cases of elephantiasis have been seen from Chung-ming Island situated at the mouth of the Yangtze River.

Filariasis has been reported frequently in eastern FUKIEN PROVINCE, especially in Amoy and its vicinity. Manson estimated the incidence in Amoy to be about 10 percent. Maxwell (1929)

in Changpu found that 25 percent of the general population had filariasis and that 2.4 percent of his hospital cases entered because of this disease. Feng (1933) examined 161 prisoners in Amoy and found 22 infected with W. bancrofti and one with W. malayi. However most of the prisoners were not natives of Amoy. The case with W. malayi came from Wenchow in CHEKIANG PROVINCE. Culex quinquefasciatus was the only mosquito found naturally infected with W. bancrofti.

In Chao-chow, near Swatow (KWANGTUNG PROVINCE) Whyte (1909) found that 49 of 600 persons examined had microfilariae. During 1933, 1934 and 1935 a number of thick films were taken at 10 A. M. from prisoners admitted daily to Victoria Goal (Jackson, 1936); 1.2 percent had microfilariae. All of the filarial parasites encountered were W. bancrofti. Dissections of mosquitoes disclosed the following species to be naturally infected in Hongkong: Anopheles minimus, A. jeyporiensis candidiensis, A. maculatus, A. hyrcanus sinensis, and Culex quinquefasciatus. The Lui-Chow Peninsula in the southern part of Kwangtung and the Hainan Island are also endemic.

According to Feng (1933) W. malayi has been found very frequently in cases of filariasis in Huchow in CHEKIANG PROVINCE. It seems that it is the only species found in this region. Feng and Yao (1935) examined 2,112 patients during the period from October 1932 to August 1933. Two thick blood smears were taken from each patient at night between 11 P. M. and 1 A. M. Of this total, 44 (2.1 percent) were found positive for microfilaria. Of the 44 positives, 38 were W. malayi, two W. bancrofti, and four mixed. Both the bancrofti and the mixed infections came from the northern part of the district, namely from the neighborhood of Changhsing and Nanshun. The cases from all the other parts of the district were infected with W. malayi only. The two bancrofti cases were natives of ANHWEI PROVINCE.

Feng (1934) showed that A. hyrcanus sinensis and Mansonia uniformis are suitable intermediate hosts for the transmission of filariasis in this district. Wenchow, further south along the coast in the province, is also known as an endemic focus of W. malayi.

Cases of W. malayi have also been reported from HUNAN PROVINCE . Liu (1937) reported that W. malayi was demonstrated in two persons among 79 inpatients in the Hsiang Ya Hospital at Changsha. In these cases there were no symptoms suggestive of filariasis. A third case was observed by the author from a native of Tseng-Chow in southern HUNAN PROVINCE. Two cases of filariasis caused by W. malayi were reported from Shanghai by Yen and Chang (1935) but it was pointed out that there is no reason to assume that these were autochthonous.

Yen (1934) as well as Feng and Yao (1935) have observed the nocturnal periodicity of the microfilariae of both W. bancrofti and W. malayi.

Feng (1933) made a comparative study of the anatomy of the microfilariae of W. malayi and W. bancrofti and found that the bancrofti microfilariae of China were identical with those of other parts of the world and that those of malayi agreed in their morphology with the descriptions of Brug of Netherlands Indies specimens.

Mosquito Vectors of Filariasis in China -- Since the discovery of Manson that Culex quinquefasciatus (C. fatigans) is vector of W. bancrofti at Amoy, little information had been obtained on the transmission of filariasis in China until 1930. Lee (1926, 1930) reported Culex pipiens as the possible vector in northern KIANGSU PROVINCE but stated that the experiments are inconclusive because larvae were found only in the thoracic muscles. On the basis of Lee's findings, Faust (1929) assumed that C. quinquefasciatus is probably the primary intermediate host of the infection in southern China, where it is the most common mosquito, and that from the Yangtze River northward C. pipiens, which replaces quinquefasciatus, is the most probable vector. Since 1930 much work has been done on the mosquito transmission of the disease.

1. Vectors of Wuchereria bancrofti -- In addition to Culex quinquefasciatus and C. pipiens pallens the following species of mosquitoes have also been found naturally infected with W. bancrofti in China: Anopheles hyrcanus sinensis, Culex tritaeniorhynchus, Armigeres subalbatus, Aëdes albopictus, Anopheles minimus, Anopheles jeyporiensis candidiensis, Anopheles maculatus, Anopheles splendidus. In Woosung district of Shanghai, Feng (1930) reported that 11 percent of Anopheles hyrcanus sinensis caught in nature showed filarial infection and about 16 percent of the infected specimens had mature larvae. Culex pipiens, although showing a higher percentage of infection, harbored no larvae of the infective stage. Feng (1931) stated that in the country of

Woosung, where elephantiasis of legs is common, Culex quinquefasciatus is absent. Owing to the lack of stagnant water C. pipiens also does not seem to be abundant. However, A. hyrcanus sinensis and C. tritaeniorhynchus are common in the houses. In the town of Woosung, C. pipiens and other species of culicine mosquitoes are very common and A. hyrcanus sinensis occurs only in small numbers. Among the inhabitants elephantiasis is said to be rare. This is a good indication that A. hyrcanus sinensis is one of the most important vectors for filariasis in this region. According to this author, filarial larvae in early stages of development have been observed in wild Culex tritaeniorhynchus, Armingeres subalbatus (=obturbans), and Aedes albopictus, but these species do not act as intermediate hosts under natural conditions. On the other hand, Hu and Chang (1933) found that 17 percent of C. pipiens pallens collected from the home of filarial subjects in Woosung during June and July were found harboring various stages of W. bancrofti. They dissected 245 of these mosquitoes after incubation in the laboratory and found 12 percent of them with infective larvae. Infective larvae of W. bancrofti have been found to be able to survive over 79 days in C. pipiens pallens from the Shanghai area (Hu, 1935). Hu, (1939) reported that 87 A. hyrcanus sinensis collected from a filarial house in Woosung, four (4.6 percent) were found with filarial larvae, whereas of 245 C. pipiens pallens collected from this house at the same time, 42 (17.2 percent) were found with filarial larvae. Thirty of the infected pallens and three of the infected sinensis had infective larvae. In 1935 he reported that dissections of 383 A. subalbatus (=obturbans) collected during September and October, 1933, from 199 houses in the same area were negative for W. bancrofti larvae, although the C. pipiens from some of these houses were found to be positive for the parasite.

Feng (1934) stated that of 21 species of mosquitoes recorded in a survey made by Lee in 1932 in Amoy, Culex quinquefasciatus was the only species found infected with W. bancrofti.

In Hongkong, Jackson (1936) examined several species collected in Little Hongkong and Shing Mun Camp. He discovered 0.1-2.4 percent of A. minimus, 0-4.6 percent of A. jeyporiensis candidiensis, 1.4-1.5 percent of Culex quinquefasciatus, 0-0.4 percent of A. maculatus, 0-0.8 percent A. hyrcanus sinensis and 0-2.1 percent of A. splendidus were infected; sinensis and minimus, which develop infective larvae, are regarded as probable vectors.

Experiments have been carried out to observe the susceptibility of various species of mosquitoes to the infection with Wuchereria bancrofti by Stephen M. K. Hu and other workers. Hu and Yen (1933) reported that of 88 specimens of C. pipiens pallens that were allowed to feed experimentally on a subject with microfilariae of Wuchereria bancrofti, 48 (55 percent) were found to have infective filaria larvae after incubation in the laboratory. The same authors (1934) made a comparative study on the susceptibility of Culex pipiens pallens from Shanghai and C. quinquefasciatus from Foochow to experimental infection with W. bancrofti. In both species the filarial larvae were found to reach the infective stage at about the same time. Ninety percent of C. pipiens pallens (62 specimens) and 94.5 percent of C. quinquefasciatus (92 specimens) were found to have infective larvae. The average intensity of infection in the C. pipiens pallens was 14.4 larvae per mosquito while in C. quinquefasciatus the average was 7.3 larvae per mosquito.

Hu (1935-1939) made a series of studies on the susceptibility of Shanghai mosquitoes to experimental infection with Wuchereria bancrofti. Ten species of mosquitoes were experimentally fed on a heavily infected bancrofti case in Shanghai. The mosquitoes were then dissected after the completion of the incubation period of the parasite. The results of these experiments are given in Table 7. The results indicate a high susceptibility of Culex pipiens pallens (96 percent infected), Culex vagans (95 percent), and Anopheles hyrcanus sinensis (21 percent); the filarial larvae were found to complete their metamorphosis to the infective stage in all of the infected mosquitoes. The average number of infective larvae per mosquito was 9.3 for C. pipiens pallens, 10.9 for C. vagans, and 3.6 for A. hyrcanus sinensis.

2. Vectors of Wuchereria malayi. -- W. malayi was discovered in China much later than W. bancrofti and very little is known regarding its vectors in China. Feng (1934) noted that Anopheles hyrcanus sinensis and Mansonia uniformis, especially the former, are suitable intermediate hosts for the transmission of malayi in Huchow of Chekiang Province, one of the important endemic centers. Later (1936) he reported partial development in Aëdes albopictus, Culex pipiens, and Armigeres subalbatus and complete development in Mansonia uniformis and Anopheles hyrcanus sinensis. Feng (1936) also conducted experiments on the development of W. malayi in A. hyrcanus sinensis in Peiping. The mosquitoes used for the experiments were

bred from larvae in the laboratory. They were fed on a filariasis case in the P. U. M. C. Hospital harboring a suitable number of microfilariae (20-23 per 20 cmm.) at night between 10 P. M. and 2 A. M. A large number of mature larvae was obtained from the mosquitoes. The majority of the mature larvae migrated into the labium. Usually there were only a few larvae (1-6) in the labium at one time but as many as 25 were found in several specimens. In 1940-1941 Hu again performed a series of studies on the susceptibility of Shanghai mosquitoes to experimental infection with Wuchereria malayi. The results of this series are available for six species and are given in Table 8. A high degree of susceptibility was found in Anopheles hyrcanus sinensis (96 percent). This confirms A. hyrcanus sinensis as a suitable intermediate host of W. malayi in China as reported by Feng. While filarial larvae developed to the infective stage in four (22 percent) of the 18 specimens of Culex vorax only one larva was found in each of these infected mosquitoes. A low degree of suitability as intermediate host for W. malayi was found with Culex pipiens pallens, C. tritaeniorhynchus and Armigeres subalbatus(=obturbans). These species probably play a minor role, if any, in the transmission of W. malayi infection in China.

The report on the development of microfilaria of Wuchereria bancrofti in the sandfly by Yao, Wu and Sun (1938) is of interest. Eight sandflies (four Flebotomus chinensis, two F. sergenti mongoliensis, and two of an undetermined species) caught in Tsingkiangpu, Kiangsu Province were found to harbor W. bancrofti. Fifty-nine specimens of F. sergenti var. mongolensis bred in the laboratory were allowed to feed on two filarial patients with the following results: 17 of them were found to harbor exsheathed microfilariae both in their abdominal cavities and in their thoracic muscles, seven were found to harbor presausage forms in their thoracic muscles, three were found to harbor postsausage forms. Sandflies fed on the case having heavy filarial infection were found to die earlier than those fed on cases having the lighter infection. The authors considered that the failure of the microfilariae to develop into more advanced forms than the ones observed might have been due not only to the early death of the sandflies but also the unfavorable conditions for the development of the larvae under which the experiment was carried out rather than to their inability to attain their full development in these insects.

TABLE 7

EXPERIMENTS IN THE TRANSMISSION OF WUCHERERIA BANCROFTI*

Species	Number	Number Infected	Percent Infected	Number with infective larvae
Aëdes albopictus	62	48	77.4	None
Armigeres subalbatus**	102	81	79.4	None
Culex tritaeniorhynchus	181	97	53.6	4
Aedes vexans nipponi	195	140	71.8	None
Culex fuscanus	75	69	92.0	69
Culex vagans	206	189	91.7	189
Culex vagans	78	74	94.8	74
Culex vorax	29	22	75.9	21
Culex bitaeniorhynchus	90	33	36.7	1
Anopheles hyrcanus sinensis	381	80	20.9	80
Culex pipiens pallens	49	47	95.9	47

* From Hu (1935-1939)-
** Obturbans of many authors.

TABLE 8

EXPERIMENTS ON THE TRANSMISSION OF WUCHERERIA MALAYI*

Species	Number	Number Infected	Percent Infected	No. with infective larvae
Culex pipiens pallens	209	5	2.3	5
Culex tritaeniorhynchus	132	2	1.5	2
Anopheles hyrcanus sinensis	34	33	97.1	96.2 %
Culex vorax	18	4	22.2	4
Armigeres subalbatus**	149	11	7.3	11
Aedes albopictus	175	98	56.0	None

* From Hu (1935-1939).
** Obturbans of many authors.

CHAPTER III

TYPHUS

Typhus very frequently accompanies drought, flood, bad crops, famine, destructive military operations, overcrowding, and filth. Its epidemic distribution is generally determined by these factors rather than by climatologic and geographic factors. However, there is a general decrease in incidence from north to south and the disease is said to be quite rare in Kwangtung Province. Liu (1943) described typhus as endemic through almost the entire country often assuming epidemic proportions in the northern provinces. The human body louse, Pediculus humanus corporis, occurs throughout China and is particularly common in the northern provinces. Commensal rats (Rattus rattus rattus, Rattus norvegicus, etc.), the natural reservoirs of murine typhus, are common and often abundant. The oriental rat flea, Xenopsylla cheopis, the important rat-to-man vector of murine typhus has been reported from most parts of China.

Although typhus has been observed to be widespread in China practically no reliable statistics are available and those which are available do not differentiate between murine (endemic flea-borne) and classical (epidemic louse-borne). Many areas have not reported communicable disease statistics in many years and the reports of those which do report are obviously and admittedly fragmentary in most instances.

Not only is the typhus picture in China obscured by the absence of reliable statistics, but there is further confusion caused by the lack of adequate knowledge concerning the etiology and epidemiology. Until ten years ago there was general agreement that the typhus which occurred epidemically in north China was the same as the classical louse-borne typhus of Europe. This conclusion was reached in general on the basis of its epidemiology, case fatality, and some observations of the rickettsiae. However, recently Liu (1943) has shown rather convincingly that the situation is probably not that simple.

In considering the typhus situation in China it may be well to review briefly the three principal theories concerning the relation of murine and classical typhus.

(1) Nicolle theory. This theory maintains that the reported differences of behavior between the louse-borne and the flea-borne rickettsiae in laboratory animals represent a true specific difference. This was based on his experiments in which lice failed to become infected by feeding on human and simian cases of murine typhus. It is maintained that the sporadic cases are unlikely to cause epidemics and that the few epidemics which do arise from murine cases under favorable conditions die out quickly. It is contended that classical typhus is maintained in interepidemic periods by mild and inapparent cases in man.

(2) Mooser theory. According to this theory there is no fundamental difference between the rickettsiae of classical and murine typhus. This is based on experiments in which it was reported that after prolonged transfers in laboratory animals the classical rickettsiae became indistinguishable from the murine rickettsiae and conversely that the murine rickettsiae could acquire classical characteristics although retaining them only briefly. Mooser reported success in infecting body lice by feeding them on monkeys and human volunteers with murine rickettsiae. He suggested that failure to infect lice on human cases of murine typhus was due to the low concentration of rickettsiae in the blood of mild human cases. For this reason it was contended that it would be difficult to understand how lice could become infected from the mild and inapparent human cases of interepidemic periods as proposed by Nicolle. According to the Mooser theory the single rickettsia of typhus maintains its murine properties as long as it occurs only in the rat-flea-rat cycle (with sporadic human flea-transmitted cases). This is murine typhus which remains endemic and enzootic in clean and hygienic communities where there is a low incidence of lousiness. However, under conditions of much louse-infestation and crowding the rickettsiae become involved in the man-louse-man cycle and acquire the "classical or epidemic" properties with increased case-fatality rates.

(3) Zinsser theory. This theory occupies a compromising position. It agrees with the Nicolle theory that there are two types of typhus rickettsiae but also agrees with the Mooser theory that the murine rickettsiae can be modified in the direction of properties of the classical rickettsiae. It is maintained that the murine type can then give rise to epidemics and that during such epidemics

properties similar to the classical rickettsiae are developed, but only temporarily, and that these rickettsiae are not permanently changed to the historic type. He suggested that historic typhus is maintained dormantly in man with occasional recrudescent cases (Brill's disease) from which, under favorable conditions, epidemics may arise.

Liu (1943) has pointed out that until recently the prevailing opinion among such workers in Peiping as Cheer and Dieuaide (1929), Wu (1933), Gajdos and Tchang (1933), Chung and Tchang (1938), and Tchang and Lotsong (1935), as well as investigators abroad, was that the typhus of north China corresponds epidemiologically, clinically and experimentally to the European historic or classical type. Zinsser (1937) was of the opinion that classical and murine typhus both exist in north China. Liu (1943) then presented evidence indicating that much of the typhus in north China may be an epidemic form of murine typhus. In recent years typhus strains described as the murine type were isolated from the blood of cases in Peiping and from rats and rat-fleas caught in their surroundings (Wu and Zia 1938, 1939, 1941 and Liu and Chung 1939). Chung and Chang (1938) and Wu and Zia (1938), however, have isolated strains which they described as typical epidemic or classical strains.

The reports of the French investigators in Shanghai are interesting. In 1860 the archives of the Shantung Road Hospital described a severe local epidemic of typhus. Since that time until 1938, there was no typhus epidemic in China. A dozen cases outside of the International Settlement were reported in 1927 and 1932, and in 1936 there were five cases in the International Settlement. In 1938 there were eight in the International Settlement and one in the French Concession. Raynal (1938) describes the situation by stating that typhus, believed to be flea-borne, exists in Shanghai appearing sporadically especially in the colder months. Raynal et al (1939) have described the 1938 typhus epidemic in Shanghai. At that time there existed unprecedented over-population and extreme poverty in the French Concession and the International Settlement. The course of the epidemic is shown in Table 9. During the epidemic the case-fatality rate was 18 percent and increasing as the epidemic declined. There were 2-3 cases per 10,000 inhabitants. The authors considered lice, which were found in large numbers on the clothing of the cases, to be the transmitters in this epidemic. Raynal and Fournier (1939) studied two human strains obtained during the epidemic and one murine strain obtained at the same time. According to these authors the three strains were identical and it was therefore concluded that the epidemic was murine in origin. Raynal (1940) after further studies with murine strains from _Rattus rattus_ and _Rattus norvegicus_ reaffirmed his belief in the murine origin of the 1938 epidemic.

Liu (1943) summarized the available information pertinent to the question of an epidemic variety of murine origin as follows: "Some strains isolated from rat-fleas and from the blood of sporadic cases in whose environs rats and fleas proved to be infected, failed to exhibit the typical murine characteristics in laboratory animals. Other strains which on isolation did show the typical murine characteristics, gradually lost them after successive passages in laboratory animals so that they became hardly distinguishable from the 'historic' rickettsia as far as their biological properties in guinea pigs and albino rats were concerned; none of these strains reverted to their original murine attributes, as reported by Zinsser." He goes further to point out that from the blood of an isolated endemic case and from the lice in his garments, typhus strains of the murine type were recovered. Liu states further, "Subsequently, during a small epidemic in a household and several larger epidemics in different orphanages and poorhouses, the disease, from the epidemiological and clinical point of view, was found to simulate the historic disease, but typhus strains were isolated from rats, mice, and their fleas caught in their environs (during one of the epidemics in a poorhouse, there was simultaneously an epizootic among the rats); typhus strains isolated from the blood of the epidemic cases and from lice in their garments were found to share some of the attributes of the murine rickettsiae. It was concluded that when a habitually louse-infested person contracts murine typhus, the human body-louse may become infected with the murine rickettsiae and under conditions of louse infestation and overcrowding, transmit it from man to man, causing small or large epidemics according to the circumstances." Liu's theories are thus in accord with those of Raynal and his co-workers concerning the 1938 epidemic in Shanghai.

However Liu points out that the occurrence of epidemics of murine origin by no means argues against the occurrence of typical epidemics of classical typhus derived from human carriers, cases of inapparent infection according to Nicolle, or cases of recrudescence (Brill's disease).

TABLE 9

THE TYPHUS EPIDEMIC IN THE FRENCH CONCESSION AND THE INTERNATIONAL SETTLEMENT OF SHANGHAI 1938*

Month	International Concession Cases	International Concession Deaths	French Concession Cases	French Concession Deaths	Total Cases	Total Deaths	Weil-Felix Reactions Made	Weil-Felix Reactions Positive
Jan	3	1	-	-	3	1	2	1
Feb	7	1	-	-	7	1	6	3
Mar	69	5	10	-	79	5	24	15
Apr	130	34	45	6	175	40	103	47
May	295	35	64	5	359	40	152	59
Jun	253	55	39	8	292	63	59	22
Jul	96	35	6	1	102	36	14	6
Aug	19	15	7	4	26	19	6	2
Sep	11	6	6	-	17	6	5	3
Oct	4	-	3	-	7	-	3	1
Nov	3	1	3	1	6	2	6	2
Dec	7	1	2	1	9	2	4	2

* From Raynal et al (1939).

With the information available at present it does not seem possible to conclude whether the typhus situation in China is a simple matter of murine and classical typhus (in the strict sense) or whether an epidemic variety of murine is also involved. The question is one of more than passing interest since, if an epidemic murine variety does occur, there is the matter of whether or not the typhus vaccine now in use will be effective against it.

It seems probable that murine typhus occurs in all parts of China whereas epidemic typhus (classical or possibly of murine origin) is confined largely to the cooler parts of the country. One of the best known foci is the Peiping area.

In 1941 the National Health Administration reported 5,230 cases in the unoccupied provinces of China. This probably represents only a small portion of the total number of cases. Table 10 contains a partial list of localities in which typhus (type unspecified) has been reported in recent years.

The typhus situation in Manchuria, in so far as the relation of murine and classical typhus is concerned, appears to be similar to that of northern China with the possible occurrence of an epidemic murine variety.

TSUTSUGAMUSHI DISEASE

Although tsutsugamushi disease (scrub typhus) was probably known in China in the third century A. D. (Farner and Katsampes, 1944) there are no absolutely authentic records of its occurrence in modern China. The cases reported by Faust in 1923 in the Wuhan Area seem definitely not to have been tsutsugamushi disease. Several unpublished reports do not seem to have sufficient evidence to be regarded as authentic. An OX-K positive case of typhus has been reported from Kunming. It is possible that the disease occurs. Although *Trombicula akamushi* is known definitely to occur in Japan, the Pescadores, and Malaya and possibly also in French Indo-China, there are no authentic reports of its occurrence in China. However, it is possible that chiggers capable of transmitting tsutsugamushi disease do exist in China. Furthermore it is possible that the disease itself occurs in China despite the present lack of evidence.

TABLE 10

RECENT TYPHUS RECORDS IN CHINA
(Compiled From Various Sources)

Locality	Province	Years and Cases
Kwantung Leased Territory	South Manchuria	1933 (128), 1934 (81), 1935 (116)
Tientsin	Hopei	1932 (1), 1933 (1), 1934 (10), 1935 (9) 1936 (17), 1937 (9)
Peiping	Hopei	1933 (17), 1934 (4), 1935 (11), 1936 (83)
Paotingfu	Hopei	1934 (1)
Tsingtao	Shantung	1935 (6), 1936 (2), 1937 (15)
Shanghai International Settlement	Kiangsu	1933 (6), 1934 (8), 1935 (10), 1936 (10), 1937 (13), 1938 (879)
French Concession	Kiangsu	1933 (1), 1935 (2), 1936 (2), 1937 (2), 1938 (185)
Nanking	Kiangsu	1932 (2), 1933 (4), 1934 (8), 1935 (6), 1936 (3), 1937 (5)
Hangchow	Chekiang	1931 (129 deaths), 1932 (105 deaths), 1933 (5) 1934 (1), 1935 (3)
Hwaiking	Honan	1934 (1)
Hankow	Hupeh	1932 (125 deaths), 1933 (25 deaths), 1934 (68 deaths) 1935 (38 deaths)
Foochow	Fukien	1932 (125 deaths), 1933 (13 deaths), 1934 (2), 1935 (1), 1936 (5), 1937 (1)
Amoy	Fukien	1932 (1)
Swatow	Kwangtung	1932 (4), 1938 (4)
Hongkong	Kwangtung	1929 (1), 1930 (1), 1938 (2)
Canton	Kwangtung	1935 (3)
Yunnanfu	Yunnan	1933 (10), 1934 (9), 1939-40 (112)

CHAPTER IV

RELAPSING FEVER

Louse-borne relapsing fever is widespread in China and has been reported in varying frequency from most of the provinces. However, like typhus, it is definitely more prevalent in the northern and colder parts of the country. It usually occurs in epidemic proportions in localities in the north and central provinces or in the highlands of the west which have cold winters followed by warm or hot summers. Such epidemics are usually associated with either time of flood and famine or with the massing of men together in special camps for industrial purposes, conditions ideal for lousiness and the exchange of body lice. In north China it usually accompanies outbreaks of typhus fever. Under certain conditions epidemics have broken out in the south. In so far as can be determined from the information available, it appears that tick-borne relapsing fever does not occur in China.

Table 11 which is taken from Shrimpton(1936) summarizes the reported cases and epidemics of relapsing fever in China.

Incidence and distribution in China. -- Shih and Wen (1939) reviewed 337 cases of relapsing fever observed in the Peiping Union Medical College Hospital (HOPEI PROVINCE) from 1921 to 1937. In all the cases the diagnosis was proved by the finding of Spirochaeta recurrentis in the blood. The majority of the cases (79.7 percent) were between the ages of 10 to 40, and most of the cases were admitted between February to July with the highest incidence in May. The mortality rate in this series was 6.2 percent. However, in most instances death occurred because of grave complications with acute bronchitis, pneumonia or bacteremia, all of which are common. Chu, Deitrick, and Chung (1931) reported an epidemic of the disease in an asylum in Peiping from July to September 1930. Twenty-six out of 160 children in the institute were attacked by the disease.

In Shanghai (KIANGSU PROVINCE) relapsing fever has been recognized for many years. Robertson (1932) stated that in the Lester Chinese Hospital the inpatient records for a period of 25 years, show that only three years passed without admissions for recognized relapsing fever. From 1929 to 1932 the number of relapsing fever admissions steadily increased each year, being 31 in 1929, 56 in 1930, 50 in 1931, and 234 in 1932 up to July. The sudden increase in 1932 was attributed to the influx of refugees from the flooded areas of the Yangtze Valley in the autumn of 1931 and the extreme congestion of population of the poorer classes in the center of the city due to the destruction of dwellings in the northern portion of the Shanghai area by military operations. Ninety-five percent of the cases were male and were found in the months of April to July. All ages from 11 months to 68 years were represented, the larger number being between 20 and 40.

Early in 1919 Skinner, Trimble and Chen reported some forty cases of the disease in Yenping, FUKIEN PROVINCE, from June to August 15, 1918. All of the cases, except one or two, were newly arrived northern soldiers. An epidemic of the disease occurred again in 1923 in Yenping also among the troops. In 1933 an epidemic broke at Amoy due to the troop movements. Further south the disease seems to disappear although sporadic cases have been reported from time to time. The low incidence of the disease in the south may be ascribed to the smaller number of reservoirs of the spirochaete and to the shorter period of favorable conditions for the spread of the vector. Relapsing fever is epidemic in the highland of the provinces of HUPEH, SZECHWAN, ~~SINKIANG~~ and YUNNAN.
SIKANG

In HUNAN PROVINCE relapsing fever first appeared in 1911 and sporadic cases have been observed since. Chang (1938) reported that two cases in 1933 and six cases in 1934 were treated in the Hsiang Ya Medical College Hospital at Changsha. In 1935 an epidemic of 16 cases and in 1936, 18 cases were reported from the city. The author studied 41 cases of relapsing fever treated in their College Hospital and demonstrated a very definite seasonal prevalence of the disease, the maximum incidence occurring in the months of May and June. The mortality in this series was 10 percent.

Shrimpton (1936) conducted an extensive survey of the incidence of relapsing fever in China for 1933 and 1934. His data were based on the hospital returns of the survey of hospital patients for those years, hospital reports, and references in the literature. Table 12 shows the geographical distribution of the disease according to province for 1933 and 1934.

As mentioned above the disease attained its maximum number of cases in May and June in both Shanghai and Peiping. Under normal conditions the seasonal distribution of the disease is essentially similar elsewhere in the country as shown in Table 13-A Both the onset and decline of the disease is more or less rapid. In Tsinan, Shantung, this curve was modified to a great extent by the abnormal conditions existing in 1933 when a serious flood of the Yellow River occurred. The distributions show an intimate connection with temperature. In Yunnanfu where there is less annual temperature fluctuation, the disease shows a much less marked seasonal variation.

Transmission -- Biologically there are two groups of relapsing fever spirochaetes, one transmitted by lice and the other by ticks. The Chinese strain of *Spirochaeta recurrentis* has been demonstrated to be of the first group, i. e. that transmitted by the body louse, *Pediculus humanus corporis*. In Shanghai, Robertson (1932) stated that body lice were found on all of the relapsing fever patients. He examined a total number of 147 lice and found spirochaetes present in 22 of them, the louse-infection index being 15 percent. Twenty-two mice were inoculated with the fluid extracted from the lice and five, or 23 percent, were found infected. From these data he concluded that the relapsing fever, which had appeared in Shanghai since the beginning of 1932 was transmitted by lice. Chung (1936) found that the body lice caught from the clothing of the relapsing fever patients in Peiping, contain *S. recurrentis*. Body lice infected with *S. recurrentis* produced relapsing fever when injected into Chinese squirrels. Infection with the spirochetes of relapsing fever can easily take place through contact of the organisms with normal skin and mucous membranes of Chinese squirrels. Squirrel-lice caught from experimentally infected Chinese squirrels contain *S. recurrentis* which cause relapsing fever in normal splenectomized squirrels when instilled in the conjunctiva and oral mucosae.

The results of the experiments on the transmission of relapsing fever in north China performed by Chung and Wei (1938) further confirm that the bites of infected lice are innocuous but that the disease may be contracted through crushing the infected lice on the skin or through introducing the infective material to the conjuntivae.

The development of the Chinese strain of *S. recurrentis* in the body lice has been studied by Chung and Feng (1936). The same authors (1937) made attempts to infect *Ornithodorus moubata* with the Chinese strain of *S. recurrentis* and reported that this strain does not behave in the tick in the same way as the Russian and American strains which, according to the work of Manteufel and Neumann, can be easily transmitted to laboratory animals by *O. moubata*. The infection with the Chinese strain of *S. recurrentis* of Peiping cannot be maintained in either young or adult *O. moubata*. In their studies on the development of this strain in *Cimex lectularius* (1938) they found that this bedbug is not a normal vector of *Spirochaeta recurrentis* in China. The latter does not go through in invisible evolutionary form in bedbugs. Bites of infected bedbugs are not infectious to splenectomized squirrels although it has been shown that the organisms are infective to squirrels after more than 25 hours in bedbugs. Bedbugs can become infected by biting infected squirrels and presumably human cases.

TABLE 11

REPORTED CASES OF RELAPSING FEVER FROM THE AVAILABLE LITERATURE*

City	Province	Cases	Period	
Fushun	Liaoning	10	1912	N.M.J. 1931 (17):233
Fushun	Liaoning	160	1915	N.M.J. 1931 (17):233
Kailan (Kaiping)	Hopei	Frequent	1931-1932	Hospital Reports
Kailan (Kaiping)	Hopei	Epidemic	1934	Hospital Reports
Tangshan	Hopei			Hospital Reports
Peiping	Hopei	Epidemic	1864-1865	N.M.J. 1931 (17):233
Peiping	Hopei	Sporadic	1894	C.M.J. 1894 (8):222
Peiping	Hopei	26	1930	N.M.J. 1931(17):224
Peiping	Hopei	Epidemic	1928-1934	Hospital Reports
Tientsin	Hopei		1877	Customs M.R.(14):66
Shuntehfu (Singtai)	Hopei	Sporadic	1931	Hospital Reports
Tengchowfu (Penglai)	Shantung		1889	C.M.J. 1890(4):164
Tengchowfu (Penglai)	Shantung	10	1890	C.M.J. 1890(4):164
Chefoo	Shantung	Sporadic	1928,1931 1933	Hospital Reports
Tsingtao	Shantung	Frequent	1911	N.M.J. 1931(17):233
Tsinan (Licheng)	Shantung	Frequent	1929-1933	Hospital Reports
Tsinan (Licheng)	Shantung	Frequent	1931	N.M.J. 1931(17):782
Kaifeng	Honan	Frequent	1932	Hospital Reports
Kiakiawang	Kiangsu	Frequent	1904	Arch. Med. Naval 1904(32):363
Shanghai	Kiangsu	Frequent	1913	J. Trop Med. 1916:63
Shanghai (Int.Settlement)	Kiangsu	Epidemic	1930-1934	S.M.C. Annual Reports
Shanghai (French Concession)	Kiangsu	Epidemic	1930-1934	Concession Francais Reports
Soochow (Wuhsien)	Kiangsu	Sporadic	1932-1934	Hospital Reports
Changchow (Wutsin)	Kiangsu	Sporadic	1918-1934	Hospital Reports
Tsingkiangpu (Hwaiyin)	Kiangsu	Sporadic	1932-1934	Hospital Reports
Chenkiang	Kiangsu	Sporadic	1930-31, 1933-34	Hospital Reports
Anking (Hwaining)	Anhwei	4	1911	C.M.J. 1913(27):318
Wuhu	Anhwei	Sporadic	1931	Hospital Reports
Luchowfu	Anhwei	Sporadic	1933-1934	Hospital Reports
Hangchow (Hanghsien)	Chekiang	Sporadic	1912	C.M.J. 1913(27):333
Hangchow (Hanghsien)	Chekiang	No Cases	1930-31, 1934	Hospital Reports
Huchow (Wuhing)	Chekiang	No Cases	1930-1931	Hospital Reports
Ichang	Hupeh	Epidemic	1910	C.M.J. 1911(25):47
Ichang	Hupeh	Epidemic	1926	C.M.J. 1926(40):162
Wuchang	Hupeh	Sporadic	1928-1934	Hospital Reports
Hankow	Hupeh	Sporadic	1930-1933	Hospital Reports
Teian (Anlu)	Hupeh	No Cases	1930	Hospital Reports
Wusueh	Hupeh	Sporadic	1930-1933	Hospital Reports
Nanchang	Kiangsi	Sporadic	1926-1932	Hospital Reports
S. Hunan	Hunan	Sporadic	1911	C.M.J. 1912(26):5
Paoking (Shaoyang)	Hunan	Sporadic	1913-1934	Hospital Reports
Paoking (Shaoyang)	Hunan	Epidemic	1935	Hospital Reports
Liling	Hunan	No Cases	1926	Hospital Reports
Changteh	Hunan	Sporadic	1910-1913	C.M.J. 1913(27):321
Chengtu	Szechwan	Epidemic	1911	Bull.Soc.Path.Exot. 1911(4):510
Chengtu	Szechwan	Epidemic	1911-1919	Bull.Soc.Path.Exot. 1920(13):38
Chengtu	Szechwan	Epidemic	1932-1934	Hospital Reports
Yachow (Yaan)	Szechwan	Epidemic	1933-1934	Hospital Reports
Chungking (Pahsien)	Szechwan	Sporadic	1910-1911	C.M.J. 1911(25):328
Yenping	Fukien	35-40	1918	C.M.J.1919 (33):210
Yenping	Fukien	Epidemic	1923	C.M.J. 1924(38):397

TABLE 11 (Cont'd)

City	Province	Cases	Period	
Amoy	Fukien	Sporadic	1930-1934	Hospital Reports
Amoy	Fukien	Epidemic	1933	Hospital Reports
Fatshan	Kwangtung	Sporadic	1933-1934	Hospital Reports
Canton	Kwangtung	Sporadic	1929-1934	Hospital Reports
Pakhoi	Kwangtung	Sporadic	1904	J.Trop.Med.1904:35, 1905:131
Hongkong	Hongkong	Epidemic	1864-1865	N.M.J. 1931 (17):233
Hongkong	Hongkong	Sporadic	1928-1934	Med.Dept.Ann. Report
Mengtze (Mengtsen)	Yunnan	194	1909	Ann. d'hyg. de la Med. col. 1911:400
Atuntze	Yunnan	Epidemic	1925	C.M.J. 1932(46):853
Likiang	Yunnan	Epidemic	1927	Private Communications: H. G. Thompson
Patang	Sikang	Epidemic	1924	C.M.J. 1932(46):853
Patang	Sikang	Epidemic	1923,1925	C.M.J. 1926(40):181
Sharatong	Sikang	Epidemic	1924	C.M.J. 1932(46):853

* From Shrimpton.

In 1944 a serious epidemic occurred in Amoy, Foochow, and Putien. A thousand cases were reported to have been hospitalized.

TABLE 12

DISTRIBUTION OF RELAPSING FEVER
IN CHINA (1933-4)

Hospital Locality	Province	Reported Cases 1933	1934
Peiping	Hopei	23	-
Tientsin	Hopei	2	4
Paotingfu	Hopei	-	6
Tśinan	Shantung	56	1
Changte	Honan	0	1
Hwaiking	Honan	0	0
Kweiteh	Honan	0	0
Suchowfu	Kiangsu	1	4
Nanking	Kiangsu	4	3
Shanghai	Kiangsu	52	92
Hofei	Anhwei	-	1
Wuhu	Anhwei	3	0
Siangyang	Hupeh	0	0
Teian	Hupeh	0	1
Hankow	Hupeh	17	49
Wusueh	Hupeh	0	0
Hangchow	Chekiang	1	3
Nanchang	Kiangsi	6	26
Changteh	Hunan	0	-
Changsha	Hunan	0	0
Hengchow	Hunan	0	0
Foochow	Fukien	-	7
Kulangsu	Fukien	4	2
Swatow	Kwangtung	2	-
Canton	Kwangtung	1	1
Hongkong	-	0	-
Yunnanfu	Yunnan	47	84

TABLE ~~18~~ 12A

SEASONAL DISTRIBUTION OF RELAPSING FEVER
IN DIFFERENT PARTS OF CHINA

Locality	Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Shanghai (Foreign Settlements)	1930-34		3	43	86	199	187	95	10	4		1	4	632
Shanghai (Lester)	1933-35	1	4	2	32	69	87	34	9	2		3	2	245
Shanghai (St. Luke's)	1930-34			4	7	20	33	14	7	1		1		87
Hankow	1933-34		2	2	11	29	17	4		1				66
Nanking	1929-34				4	9	14	7			1	1		36
Peiping	1933-34	1	1	1	5	15	5	5	1	1	3		1	39
Tsinan	1933-34		23	23	1	9	1							57
Nanchang	1933-34		2	7	6	3	6	7	1					32
Yunnanfu	1933-34	13	12	16	17	10	8	9	12	11	6	5	12	131

CHAPTER V

KALA-AZAR

Kala-azar, caused by Leishmania donovani, occurs in three well-known endemic regions, the Mediterranean region, India, and China. In China the important endemic areas of the disease are north of the Yangtze Valley, including the provinces of Kiangsu, Anhwei, Shantung, Honan, Hopei, and Liaoning. Scovel (1944) in his important treatise on this disease in China stated that 5,000 cases are treated annually in three hospitals in the endemic area of Kiangsu~~, Hupeh, Szechwan, Kwangsi (Boshamer, 1935), and Sikang.~~ In addition, kala-azar cases have been reported from the provinces of Kansu, Shensi, Chekiang, Kiangsi, Hupeh. It has been reported that, due to the movement of troops during the war, the disease has spread as far south as Canton where 84 cases were reported by Schretzenmayr, Chue and Tsen (1938).* In 1941 Yao and Wu (1941) discovered the presence of Flebotomus chinensis, the most important Chinese vector, in Yunnan Province. Considering the presence of the vector, and the possible introduction of cases, especially in wartime, into the southern provinces, endemic areas may eventually be found in southern China. It is possibly not far from the fact to state that the disease exists more or less endemically throughout China.

A great deal of research on Chinese kala-azar has been done by the investigators of the Peiping Union Medical College and of the Kala-Azar Research Station of Tsingkiangpu, north Kiangsu during the last two decades.

Incidence of kala-azar in China. -- Kala-azar is an important public health problem in parts of north China. It is most prevalent in the dry regions north of Yangtze, including northern KIANGSU, eastern ANHWEI, SHANTUNG, eastern SHANSI, and HOPEI. The infection extends northward as far as Neuchuang and Liaoning in southern MANCHURIA and westward as far as Sian and Langchow. In southern Manchuria, Taylor (1935) reported that this disease together with malaria definitely menaced the health of certain communities. Thirty-one cases were admitted to Mukden Hospital from 1929 to 1933. Many cases were reported along the Mukden-Dairen Railway and some cases were found along the Mukden-Shanhaikuan Railway (Taylor, 1931). Peiping is one of the heaviest endemic foci. Huang (1940) reported that there were altogether 554 proven cases admitted to Peiping Union Medical College Hospital during the period, from 1929 to 1939. Among these there were 42 cases, or 7.6 percent, complicated with acute agranulocytosis. Yuan, Chu and Lee (1939) studied 36 cases of kala-azar in children in the first year of life diagnosed in the same hospital from 1923 to 1938 and concluded that natural infection of kala-azar in man in north China chiefly occurs in the early part of the summer and that the period of greatest infectivity is between the middle of May and the middle of June. Wang (1937) examined the peripheral blood of 23 cases and found Leishmania bodies present in 39.1 percent of them. The parasites were found at all stages of the disease. Canine leishmaniasis is also very common in this city and its vicinity. In Paotingfu, capital of HOPEI PROVINCE, 35 cases were diagnosed as kala-azar in the Paotingfu Hospital during a period of two years (Wylie, 1920). All were males between the ages of 4-30 years. Young (1923) has recorded cases from Tientsin. In Tsinan, SHANTUNG, Hindle and Patton (1926) of the Royal Society's Kala-Azar Commission in China examined the records of 301 kala-azar cases in the Shantung University Medical School (1920 to 1926) and reported the disease to be one of the earlier decades of life and without marked seasonal prevalence in this area. The Weihsien Hospital reports of 1924 and 1925 state that kala-azar was prevalent in east central Shantung. Young (1923) recorded cases from Tsingtao. Scovel (1944) of Dackman-Hunter Hospital at Tsining (southwestern Shantung) reported 585 cases observed from January 1940 to June 1941.

North KIANGSU is probably the most heavily infected area in China. The Kala-Azar Research Station was established at Tsingkiangpu in the center of the area. Five thousand (5,000) kala-azar cases were treated in the Tsingkiangpu Hospital from April 1932 to April 1933 (Chinese Medical Journal 47:1445). Hsuchowfu, the important junction of the Tsin-Pu and Lung-Hai Railway lines in north Kiangsu, lies within this endemic area. In his reports of the incidence of disease in selected hospitals in China for 1933 and 1934, Gear (1934, 1936) showed that the Suchowfu Hospital had the greatest number of cases, 819 in 1933 and 1,643 in 1934, "which makes it one of the most important institutions in the world treating this form of leishmaniasis." A great number of kala-azar cases has also been reported from Pi-hsien, situated to the east of Hsuchowfu and near the northern border of the province (Kuroya et al, 1939 and Young, 1939).

* Dr. E. B. Struthers (personal communication) of Cheeloo University believes this report to be erroneous.

Most of the cases were confirmed by punctures of the spleen or liver with discovery of Leishman-Donovan bodies. According to Villain (1925) Kaifeng, HONAN PROVINCE, is another endemic center. In SHENSI PROVINCE, Clow (1941, 1943) reported 535 cases of kala-azar diagnosed in Sian during 1940-41 with a case fatality of 14.3 percent (1.8 percent uncomplicated kala-azar). Many of the cases were infected in the Kuan-chung-tao along the valley of the Wei River. As many of the patients were young children who were born in this area and have never been outside its confines, the disease is believed to be endemic in this province and tends to assume epidemic proportions.

In central, southern and western China only sporadic cases of the disease have been reported.

In Shanghai, the first Chinese canine kala-azar case was reported by Andrews (1933, 1934). However, she expressed the opinion that the infection was probably acquired in Mukden where the dog was born. In southern KIANGSU, south of the Yangtze River one human case was reported from Sungkiang, some fifteen miles south-west of Shanghai (Morris, 1931).

Sturton (1931) reported one possible ~~autochthonous~~ case from Kiangshan in CHEKIANG PROVINCE on the Chekiang-Kiangsi border, and cases have also been reported from Kwang-sin on the KIANGSI side of the Chekiang-Kiangsi border. Mi and Yang (1937) recorded the first case of kala-azar from Nanchang, the capital of Kiangsi but considered it to have been introduced from north of the Yangtze River.

McClelland (1941) reported 15 cases from Anlu, HUPEH PROVINCE, about 70 miles north-west of Hankow in 1936-1937. The patients came exclusively from among the peasant class and without exception had been born in the places from which they had come to the hospital. It is believed that in this district the disease occurs with sufficient frequency to constitute an endemic focus.

The existence of the disease in the western part of Szechwan has been definitely proven by Du and Best (1936), Hou (1943), and Lenox et al (1943). Du and Best (1936) reported one case treated in West China Union University, Chengtu. Hou made a special trip to Lifan in the summer of 1943 where cases of kala-azar had been reported. He encountered several cases in the villages and cities he visited between Lifan and Kwan-hsien. Sandflies were also found where cases of kala-azar were found. Lenox et al examined seven children from a kala-azar patient's home and found four of them with enlarged spleens.

As mentioned previously an epidemic of kala-azar, resulting from the movement of troops, has been reported in the region of Canton, KWANGTUNG PROVINCE in 1938 (Schretzenmayr, 1938, and Schretzenmayr, Chue and Tsen, 1938). Eighty-four cases were reported in five months. The epidemic was supposed to have been introduced from the north but 27 cases were observed in the patients who had never been outside of the province. Dr. E. B. Struthers (personal communication) formerly of Cheeloo University has made the following comments concerning the Canton epidemic. "As many of the patients in the supposed Canton epidemic described by Schretzenmayr, Chue and Tsen, did not have symptoms typical of kala-azar and as no typical Leishman-Donovan bodies are evident in the illustration published with the article, it is doubtful if this was an epidemic of kala-azar. It is even possible that none of the cases were suffering from this disease."

It, therefore, seems highly doubtful that kala-azar occurs in this region.

Insect vectors of kala-azar in China. -- Recent workers in the field of leishmaniasis all agree that the disease is transmitted by blood-sucking insects. Of these the only group definitely proven to be the transmitting agents are the sandflies of the genus *Flebotomus*. As Hoeppli (1940) remarked, the distribution of sandflies in various countries corresponds very well to that of kala-azar. Wherever kala-azar exists, sandflies are also found, whereas in places where such insects are not known, this disease is also unknown. *Leishmania donovani* bodies have been shown developing to flagellates in bedbugs and fleas but neither of the insects were proven to be the actual vector under natural conditions

Several species of *Flebotomus* are believed to be concerned in transmission of *L. donovani* in different regions. In the Mediterranean region *F. perniciosus* and *F. papatasii* are considered to be the vectors of leishmaniasis. In India the disease is found to be transmitted by *argentipes*.

In China nine species and four varieties of Flebotomus have been recorded (Yao and Wu, 1941). Research on the relationship of these sandflies to the leishmaniasis has been done at Peiping and Tsingkiangpu in the last 20 years. It has proved that among these human blood-sucking species F. chinensis is the most important transmitter of the disease in this country. In 1927 Patton and Hindle reported that F. chinensis is experimentally a very favorable host for the development of the Leishmania of Chinese kala-azar and that there is strong evidence that this species is concerned in the transmission of the disease in north China. At the same time their results with F. sergenti mongolensis, although of quite different characters,suggest that this species cannot be entirely ignored in considering possible vectors of the parasite. Young and Hertig (1927) came to similar conclusions in Hsuchowfu. Hindle (1928), in confirming their earlier conclusions, reported that F. chinensis is the most favorable species for the development of the Leishmania and that in this insect the flagellates become attached to the lining of the mid-gut and grow forward until they reach the anterior part of the gut. Invasion of the pharynx usually takes six days and under favorable conditions about 25 percent of the flies show a proboscis infection. He also showed that F. sergenti mongolensis is an equally favorable host for the early development,but in this species the infection remains confined to the posterior region of the mid-gut, and does not become attached to the lining of the gut, and never invades the proboscis.

Wu and Sun (1938) fed the laboratory bred sandflies of three species, F. chinensis, F. sergenti mongolensis and F. kiangsuensis (?) which were found in Tsingkiangpu on kala-azar patients and infected hamsters. The infective rates of the sandflies were found to be 56.3 percent for F. chinensis, 11.7 percent for F. sergenti mongolensis, and 32.7 percent for F. kiangsuensis. The flagellates were well developed, actively motile and reached a high degree of infectivity four to six days after the initial feeding.

Sun, Yao, Chu and Wu (1936) dissected 421 female F. chinensis collected from the houses of kala-azar patients in Tsingkiangpu during the months of June and July and found seven of them harboring in their mid-gut flagellates which are morphologically indistinguishable from those of L. donovani. O-shaped bodies were found in 26 F. chinensis in the kala-azar infected houses. F. sergenti mongolensis and F. squamirostris were also collected but no dissection of these species was reported. Sun and Wu (1937) found 11 out of 537 F. chinensis collected from two villages of Tsingkiangpu to be naturally infected with L. donovani. Yao and Wu (1941) reported that in 1937, 6.4 percent of 517 F. chinensis caught from kala-azar houses in a village of Tsingkiangpu were found to be infected with the similar flagellates.

In Peiping, Feng and Chung (1939) reported that both F. sergenti mongolensis and F. chinensis could be readily infected when fed on dogs infected with canine Leishmania. The rate of infection of the flies was directly related to the degree of infection of the skin of the dogs. The development of flagellates of Leishmania apparently occurred readily in both F. sergenti mongolensis and F. chinensis , but the latter appears to be a much better intermediate host.

Chung and Feng (1939) collected 16 F. chinensis between the 5th and 10th of June in a house where a dog was naturally infected with kala-azar in Peiping. Flagellates morphologically identical with those of L. donovani were discovered from two of these flies. They believed that natural infection of F. chinensis with flagellates occurs in the first week of June, if not earlier. Two years later the authors again (1941) demonstrated the natural infection of F. chinensis with Leishmania flagellates in Peiping. From the dissections of 57 sandflies, captured from a kala-azar dog kennel, 34, or approximately 60 percent, were found to be naturally infected with the flagellates. A normal Chinese hamster inoculated subcutaneously with the flagellates recovered from two of the sandflies showed a moderately heavy viceral leishmaniasis ten months afterwards.

According to Sinton (1928) the distribution of F. chinensis extends from China to the Caucasus and southward to the foothills of the Himalayas in India. In China, according to Yao and Wu (1941), the species is definitely known from Peiping, Tunghsien and Tientsin in HOPEI PROVINCES; Taian and Tsinan in SHANTUNG PROVINCE; Hsuchow, Tsingkiangpu, Haichow, Lienshui and Szeyang in KIANGSU PROVINCE; and Sian of SHENSI PROVINCE. All these districts are already generally known to be the endemic areas of kala-azar. Not only does F. chinensis prevail in the endemic area but it can be readily found in large numbers during the season in the kala-azar houses in the area. More recently it has been found in YUNNAN (Yao and Wu, 1941). It is possible that these sandflies are present throughout China, including the southern provinces.

For a long time canine leishmaniasis has been known from the Mediterranean region where the dog is considered to be an important reservoir host of human infection. This animal is naturally infected with a leishmania identical with L. donovani and is readily infected with the parasite experimentally. In India, however, canine kala-azar is rarely found although human cases are very common and no reservoir host of the disease has been determined. It was believed that the kala-azar of China was similar to that of India until the discovery of the canine cases from Peiping by various authors. Prior to that time, Andrews (1933, 1935) recorded a case of canine leishmaniasis from Shanghai but the infection was supposed to have been acquired in Mukden. Lee (1937) reported two naturally infected dogs from Peiping one of which was from a house in which there was also a case of human kala-azar. Feng, Chung and Hoeppli (1939) reported twelve naturally infected cases of canine leishmaniasis showing skin lesions from Peiping and expressed the belief that kala-azar in dogs is probably much more common in China than it is generally suspected. Ho (1939) reported that one of these twelve dogs belonged to a family in which there was a child with kala-azar. Chung, Wang, Lee and Liu (1939) examined 587 apparently normal dogs in Peiping for leishmania infection and found the parasite present in eight, or 1.4 percent of them. Chung and Wang (1939) experimentally inoculated five normal Chinese hamsters (Cricetulus barabensis griseus) and another five recently cured of an infection with Leishmania donovani. Of the latter five, two acquired what appeared to be a relative immunity and three a solid immunity against an infection with Leishmania canis. The controls all succumbed with the infection. From these findings the authors concluded that L. donovani and L. canis are either identical or very closely related. Chung (1940) reported that the Chinese organism behaved like the Mediterranean organism, the slight difference being that it attacks both adults and children. The author claimed that their work has yielded epidemiologic and laboratory evidence that the Chinese human leishmania and the Chinese canine leishmania are identical and that the dog is a natural reservoir of the human disease in China. She added that the identity of L. donovani and L. canis has not yet been definitely proved, but it is very difficult to suggest any good reason against this view.

An examination of dogs for evidence of leishmania infection was carried out by Chung and Li (1940) in three villages in the west suburbs of Peiping. They examined 93 dogs, 65 at random and 28 selected. Five of the former group and twelve of the latter group were found to be naturally infected with kala-azar. A very close association of canine and human kala-azar is reported to exist in this area. In the authors' opinion, the failure to eradicate kala-azar by mass treatment and complete care of all human cases in 1937 was probably due to the presence of canine leishmaniasis serving as an important reservoir for human infection.

Hoeppli (1940) in his treatise on the epidemiology of kala-azar in China summarized the relationship of the canine and human leishmaniasis in China as follows: "Although the infection rate of sandflies fed experimentally infected hamsters (Cricetulus barabensis griseus) is very high, it is rather low when they feed on human cases. Canine leishmaniasis is very common in Peiping. Numerous L.D. bodies are usually found under the skin of infected dogs. In consequence, sandflies fed on them can be easily infected. The infection rate, in certain cases, reaches 90 percent. If canine leishmaniasis can be proven to be identical with the human infection and if successful transmission from dog to man is attained, dogs have to be regarded as playing an important role in the epidemiology of kala-azar in China."

CHAPTER VI

PLAGUE

Plague has existed in China for many centuries. It has been suggested with considerable evidence that the original focus of plague, from which the disease spread to all parts of the world, was in northwestern China or Outer Mongolia. Plague in China is predominantly bubonic especially in the southern provinces where the epidemics usually occur in the warm summer months. In the north epidemics which are almost completely pneumonic sometimes occur. In this region plague epidemics usually begin in late summer or fall and extend into the winter. In the south isolated pneumonic cases are reported; these are almost always bubonic cases which have become pneumonic secondarily. According to Wu (1926, 1935) the greater prevalence of pneumonic plague in the north is due to the seasonal character of the epidemics. Low temperatures, low humidity, together with crowded conditions, poor ventilation, and close contact with the patients enhance the chances of respiratory infection from secondary pneumonic cases. These conditions do not exist to the same degree in the south and the chances of direct infection from secondary pneumonic cases are much less. Wu has suggested further that in the north there is a predisposition to acute respiratory infections of all types and that the development of both primary and secondary pneumonic cases is thereby facilitated.

Prior to the outbreak of Sino-Japanese hostilities epidemics of plague were largely restricted to the southern provinces of Fukien and Kwangtung, a few areas in the north such as Transbaikalia, southern Manchuria, and the Shansi-Shensi area. Plague epidemics in the north can, almost without exception, be traced back to the enzootic sylvatic plague of central Asia. The same has been said of the southern epidemics although the relation is more obscure. Although there can be little doubt that the plague of southern China was derived originally from central Asia, there is now some evidence that the disease may remain enzootic in domestic rats in interepidemic periods, a condition which does not appear to exist in the north. In the south where the disease is of relatively recent importation Hongkong and other seaports have frequently served as dispersal centers. The northern foci are situated near or are in contact with the endemic and enzootic areas of central Asia. It is of interest to note that in the south the epidemics are usually transported over the waterways, either marine or inland, whereas in the north the routes are overland. In recent years large epidemics have been reported from Chekiang and Hunan. There have been suggestions that plague as an instrument of bacterial warfare has been used in these provinces.

Because of its widespread recorded distribution in China, its possibly undetected occurrence in rodent populations, the favorable situations created by military operations, and its possible use as a bacterial warfare measure, plague should be regarded as an actual or potential hazard throughout coastal China.

Case fatality rates are usually very high; 75-95 percent in bubonic plague and nearly 100 percent in the pneumonic type. The seasonal occurrence of plague is different in the north than in the south. In the north the epidemics usually begin in summer or autumn and extend into the cold season whereas in the south the outbreaks commonly start in the spring and end in the course of the summer. Table 13 summarizes the seasonal incidence of plague in China.

In general epizootics in the common commensal rats, *Rattus rattus* and *R. norvegicus*, are the immediate sources of infected fleas in epidemics; *Xenopsylla cheopis* is the principal rat-to-man vector except in the tarabagan districts in the north where the disease is enzootic among the Siberian marmots (tarabagans). Their principal flea, *Oropsylla silantiewi*, is the rodent-to-rodent vector and is probably the vector involved in the sporadic human bubonic cases which arise in these areas. The development of some of these cases into pneumonic cases may mark the beginning of epidemics of pneumonic plague. Extensive bubonic epidemics, even in these regions, apparently do not occur without the development first of epizootics in commensal rats.

The history of plague in China is well summarized in the communications of Wu Lien-Teh and his colleagues in the Manchurian Plague Prevention Service and the National Quarantine Service. Most of the information in this report is derived from the papers of this group. King (1943) furnishes most of the information from war-time China.

Although plague appears to have been enzootic in MONGOLIA and TRANSBAIKALIA since

time immemorial, it was not recorded in scientific literature until 1863. Even in these areas the majority of the outbreaks have been bubonic with relatively small numbers of primary pneumonic cases. However, on occasion large epidemics of primary pneumonic cases have developed. As mentioned above, plague in this area is enzootic among the tarabagans (Marmota bobak=Arctomys bobak); the principal vector is the tarabagan flea, Oropsylla silantiewi. Most of the outbreaks of human plague in this area originate in late summer or autumn when people are camping in the fields for hunting or harvesting. Under such conditions they come in close contact with these rodents and their fleas. The disease in this region seems quiescent at present; there has been no information of human outbreaks since 1928. Nevertheless it unquestionably persists among the rodents and is therefore a constant hazard.

In Harbin (central MANCHURIA) the first epidemic in recent times occurred in the winter of 1910-11. It lasted from November to February; there were 9,000 deaths, a death rate of 90 per thousand. The second epidemic occurred in 1921, from January to May; there were 3,125 deaths and a death rate of ten per thousand (Chun, 1923). Plague in Manchuria is clinically and epidemiologically peculiar in that it is frequently almost exclusively pneumonic and septicemic. The role played by domestic rats and the rat fleas is negligible beyond the fact that the early pneumonic cases in the epidemics are probably secondary manifestations of bubonic cases which may have been contracted from infected rat fleas. The Mongolian marmots are unquestionably the ultimate sources of the plague epidemics and it is possible that they are the immediate sources in that the original few bubonic cases in the epidemics may have been caused by marmot-infected fleas. Hiroki (1934) described the plague epidemic at Nungan (KIRIN PROVINCE) in 1933. There were 624 deaths from July to November with the greatest number in August and September. This epidemic was almost entirely bubonic although towards the end pneumonic cases developed. The port of Newchwang in south MANCHURIA became infected as early as 1899. The disease has reappeared in this city and the surrounding area many times. In the Tung-liao and other areas in southern MANCHURIA several epidemics have occurred since 1924. Here the disease was thought to have been introduced from Inner Mongolia about 1917. In this region plague tends to remain bubonic even though the epidemics frequently extend into cool weather. The immediate source of the outbreaks in this region is known to be epizootics in Rattus norvegicus which in turn are contracted from wild rodents. Xenopsylla cheopis is the rat-to-man vector as well as an important rat-to-rat vector.

Tsuchiya and Li (1929) described the bubonic epidemic of 1928 at Chienchiatien (INNER MONGOLIA) and stated that it developed suddenly during the last ten days of August and ended in the middle of November, with about 400 cases in a population of 1,300. The case fatality rate was 97.4 percent. Kurachi (1930, 1931) stated that in Inner Mongolia the epidemics usually began in June or July when the mean temperature was 60-70° F., then gradually increased to a maximum in September. About 5,000 domestic rats were examined but no infections were found. The disease seemed to spread from man to man. He supposed that the susliks were responsible for the epidemics.

Weichang in JEHOL PROVINCE was formerly another north-China plague area. In this region the plague season is also from July to November. However, in this area the pneumonic character of the disease is conspicuous. About one-third of the total cases in the 1896 outbreak were said to have been pneumonic, occurring mostly during the last one and a half months of the epidemic. Morbidity and mortality rates were very high. During the epidemics in 1896-1898 about 400 out of 658 inhabitants in five villages died with the disease. The infection seems to have disappeared in this area since 1899. In November, 1933 an outbreak was recorded in the province in a locality about 35 miles north of Chih-feng but it was considered to have been imported from the Tungliao district and not of local origin.

The SHENSI-SHANSI area is one of the oldest plague areas in China. The disease occurs here almost perennially. Epidemics usually begin in June or July and gradually decline after October. With the exception of the 1917-1918 pneumonic epidemic the infection is generally bubonic in character although there is sometimes a tendency to assume pneumonic features such as developed during the large epidemic of 1931. The 1917-1918 pneumonic epidemic began in Inner Mongolia and spread to Suiyuan, Shansi, Chahar, Hopei, Shantung, Anhwei and Kiangsu. It travelled 1,600 miles from its origin. In 1931 an epidemic broke out first in Hengshan-hsien (SHENSI PROVINCE) in June and then spread towards Yu-lin, Mi-chen, Suiteh, Anting, Tsing-kien, Wu-pu and also Ja-hsien of the same province and thence into SHANSI PROVINCE. There were no less than 20,000 deaths. It reached its maximum from September to Octob er. The plague was generally

bubonic, although pneumonic epidemics developed in the Mi-cheh and Sui-teh-hsien in October (Lu, 1933). More recently King (1943) reported that the most serious epidemic of plague in 1942 occurred in the provinces of SUIYUAN, SHANSI, SHENSI, and NINGHSIA. The epidemic which was principally pneumonic spread very rapidly and from January to April 689 deaths were reported. The sources of the epidemic outbreaks in Shansi and Shensi are epizootics among commensal rats, the only species reported to be present being Rattus norvegicus. In addition to Xenopsylla cheopis, norvegicus in Shansi and Shensi is infested with two species of Ceratophyllus. Lu (1933) includes, besides rats, Phodopus praedilectus Mori, a ground squirrel found in Yu-lin-hsien, as a source of infection.

Before the outbreak of Sino-Japanese hostilities plague epidemics occurred only occasionally in the central provinces and then were apparently extensions of epidemics in other regions. However, under war conditions in recent years severe epidemics have been reported from CHEKIANG and HUNAN. As mentioned previously there have been suggestions that these have resulted from the use of plague as an instrument of bacterial warfare.

In Shanghai only 96 cases were reported between 1910 and 1916. The seasonal incidence resembled that in north China. The seasonal incidence of rat plague in Shanghai (1909-1916) shows an increase in the latter months of the year and remains at a maximum during the winter.

In CHEKIANG, plague was reported for the first time in Ningpo and Chuhsien in the winter of 1940. King (1943) of the National Health Administration, suggested that these plague outbreaks were the result of Japanese attempts at bacterial warfare. The disease in Chu-hsien became enzootic among the rats and reappeared in epidemic proportions in the spring of 1941, causing 157 human cases with 148 deaths from March to July. The disease spread eastward to I-wu (145 cases with 110 deaths from October 1941 to March 1942) and to Tung-yang (71 cases with 67 deaths in the spring of 1942.)

Bubonic plague was imported from Fukien into Kwangtsek, KIANGSI, where there was a small epidemic of 36 cases with 30 deaths during the spring of 1941. In HUNAN PROVINCE bubonic plague broke out for the first time in Changteh in November 1941. Bacterial warfare was again suspected. The disease is reported to have become enzootic among the rodents and reappeared in March, 1942. From Chang-teh the disease was carried to Tao-yuan where there was a small epidemic in May. Wenchow had a moderate epidemic in the summer of 1944.

In south China plague has been epidemic in the provinces of KWANGSI, KWANGTUNG, and FUKIEN. In Fukien it continues to be endemic. Plague was first recorded in Fukien in 1895 when the infection was imported from Hongkong to Amoy. In 1901 Foochow was infected. The disease spread along the river routes to the interior and further from the rivers to inland districts thus establishing three primary coastal foci. In the interior, three groups of endemic foci appear to have been established along the three principal water lanes in the province, the Min, Kin, and Kiulung Rivers. In this province climatic conditions favorable to the occurrence of epidemics of plague prevail during much of the year. The onset of epidemics is determined primarily by the time of introduction of infected rats. However, once the disease becomes firmly established in a locality epidemics generally occur during the summer months. Table 14 shows the seasonal incidence of plague in the Fukien Province.

Table 14 does not include the epidemics which have occurred almost every year since 1920 in Kienow, where there were recorded 2,000-2,500 deaths in 1923; 300-400 deaths in 1924; 1,300-1,500 deaths in 1926; 300-400 deaths in 1929; and about 20-50 deaths each year from 1929 to 1936. Neither does it include the figures of deaths in Sungki from 1929 to 1935 during which period there were 200 deaths in 1929; 300-500 deaths in 1930; 50-100 deaths each in 1931, 1932 and 1933; 200-250 deaths in 1934; and 100-150 in 1935. Plague in FUKIEN PROVINCE is principally bubonic although secondary pneumonic plague, a complication in some cases, often gives rise to small epidemics of primary pneumonic cases. There were reported 554 cases with 434 deaths in 1939 and 252 cases with 178 deaths in 1940 in Fukien. King (1943) reported that in 1941 there were 626 cases with 395 deaths in twenty-one hsien in Fukien and that in 1942 plague outbreaks were reported in 18 hsien of that province. The disease seems to be on its upward trend as 5,158 cases and 4,082 deaths were reported in 1943, and the disease spread to 31 hsien with an average fatality rate of 75.2 percent. In Fukien as well as other southern provinces there is evidence that plague remains enzootic in commensal rats and that wild rodents may not necessarily be involved. Furthermore the disease is usually transported via the waterways whereas in the northern provinces it usually passes overland.

In KWANGTUNG PROVINCE, there are epidemic foci of many years' standing in Lien-chiang district and on Hainan Island. According to King (1943) there were 85 cases in Lien-chiang and Shiu-chi in 1941 and 33 cases in 1942. Uttley (1938) showed that from 1894-1923 the disease occurred in Hongkong throughout the year with the highest incidence from March to August. It seems, therefore, safe to state that the plague epidemic season in this region lasts from early spring into late summer, only rarely extending into autumn. However, the plague situation in Hainan Island seems to be different. According to Landauer (1938), most of the plague cases on this island occur from October to April. The disease was probably introduced into this island from Hongkong in 1900. Prior to 1925 it only occurred in the area north of the Tingan-Nodoa line. Since 1925 it has spread southward to Kuinghan and Tsingmai. Outbreaks of plague have been reported also in the southern provinces of KWANGSI and YUNNAN.

Rodents and rodent fleas in plague in China. -- Except in the endemic and enzootic plague foci of Outer Mongolia, Transbaikalia, and northern Manchuria, epizootics in domestic or commensal rats are the immediate sources of epidemics of bubonic plague. When domestic rats are involved the oriental rat flea, Xenopsylla cheopis, is the principal rat-to-man and rat-to-rat vector. Plague may exist enzootically in domestic rats or there may be continuous reinfections from wild rodents. In the northern areas plague is enzootic among the Siberian marmots (tarabagans); here the principal rodent-to-rodent vector is Oropsylla silantiewi. Human cases in these areas occur in late summer or early autumn when the natives are camping in the fields for hunting or harvesting. Besides the tarabagan other species of rodents such as Allactaga siberica mongolica, Citellus daurica mongolicus, and Lasiopodomys brandti (=Microtus brandti) have been found infected occasionally but are not important in the perpetuation and propagation of the disease. The common species of domestic rats appear to be rare in these regions and are never involved in the epidemiology of plague. Ando et al (1931) found two species of susliks, Citellus dauricus mongolicus and Citellus pygmaeus musicus, to be infected. Wu (1935) suggested that these species became infected incidentally to the epizootics and epidemics and had no role in causing them. Lu (1933) included Phodopus praedilectus as a source of plague infection in Shensi and Shansi.

Uttley (1938) summarized 15 years (1909 to 1923) of rodent collecting in Shanghai. The catches for this period were Rattus norvegicus 41 percent, Rattus rattus 32 percent, and Mus musculus 27 percent. Kitasato (1911) found the Norway rat to be the dominant species of domestic rat in southern Manchuria. Urabe (1934) obtained similar results in Mukden where he reported the dominant form as Rattus norvegicus caraco. Rattus norvegicus was also reported to be the dominant domestic rat of Inner Mongolia by Kurachi (1931). The results of Wu's extensive survey in seven seaports are given in Table 15. In using these data it should be borne in mind that rat populations fluctuate constantly. Furthermore, in the south norvegicus occurs primarily in the seaports and is uncommon elsewhere.

Xenopsylla cheopis is unquestionably the most important vector of plague. Throughout China, with the exception of Shanghai, it constitutes the vast majority of the domestic rat-flea population. The rarity and limited seasonal occurrence of this species in Shanghai is of interest. Hicks (1927) suggested that in Shanghai the flea mainly responsible for carrying plague is X. cheopis and that because the infection is unlikely to reach Shanghai during the season when this flea is common, it has difficulty in gaining a foothold in this port.

In addition to the three most common species, Xenopsylla cheopis, Leptopsylla segnis, and Monopsyllus anisus, other species of fleas reported from rats are: Nosopsyllus fasciatus (=Ceratophyllus fasciatus), Ctenocephalides canis, Ctenocephalides felis, and Pulex irritans. It should be noted that Hicks (1927) reported an incidence of 36.3 percent Nosopsyllus fasciatus in Shanghai without any records of Monopsylla anisus. However, Wu (1935) found only 14 specimens of fasciatus in an examination of nearly eight thousand specimens in Shanghai. He suggests that the fasciatus of Hicks was probably anisus.

TABLE 13

SEASONAL INCIDENCE OF PLAGUE IN CHINA

Locality	Season	Year
Nungan, Kirin	July - November	1933
Chienchiatien, Inner Mongolia	August - November	1928
Newchwang	July - November	1889
Newchwang	August - January	1901-02
Newchwang	October - November	1905
Newchwang	November - January	1906 - 07
Newchwang	July - October	1907
Tangshan	August - November	1908
Shanghai	September - November	1910
Shanghai	July - August	1911
Shanghai	November - December	1912
Shanghai	May - June	1913
Shanghai	September - December	1914
Foochow	April - October	1902
Amoy	March - September	
Swatow	March - August	
Canton	January - August	
Macao and Lappa	March - July	
Pakhoi	March - August	
Hainan	February - August	
Wuchow	March - August	
Lungchow	March - June	
Mengtze	May - September	

TABLE 14

PLAGUE IN FUKIEN

Year	Season	No. of deaths	Locality
1905	Sept. - Nov	200-300	Yenping
1909	Jan - June	300-350	Lungyen
1913	Mar - June	700-200?	Kienow
1918	Mar - Dec	500-600	Kienow
1918	Sept - Nov	80-100	Yenping
1919	May - July	300-400	Yenping
1920	May - Nov	200-300	Yenping
1925	April - June	200-250	Yenping
1927	August - Oct	50-100	Chengho
1928	Feb - Oct	500	Sungki
1929	April - Sept	800-1,000	Chengho
1930	June - Nov	1,000-1,200	Chengho
1931	April - May	40-50	Chengho
1931	Sept - Oct	30-50	Yenping
1932	April - May	100-120	Chengho
1933	April - May	100-200	Chengho
1934	May - July	30-50	Lungyen
1934	September	200-300	Yenping
1934	April - May	40-50	Chengho
1935	April - November	400-600	Lungyen
1935	April - December	100-150	Yenping
1935	April - May	100-120	Chengho
1936	Aug - Oct	100-150	Sungki
1936	July - Oct	30-40	Chengho

TABLE 15

RATIO OF RATTUS RATTUS* AND RATTUS NORVEGICUS COLLECTED IN VARIOUS LOCALITIES IN CHINA

Locality	R. rattus	R. norvegicus	Date	Source
Mukden**	1.8	97.5	1934	Urabe
S. Manchuria	6.0	94.0	1911	Kitasato
Tangshan	0.0	100.	1909-10	Andrew
Tangku	6.2	93.8	1931-33	Wu
Chinwangtao	0.0	100.	1931-33	Wu
Shanghai	83.6	16.4	1931-33	Wu
Hankow	36.4	63.6	1931-33	Wu
Amoy	3.9	96.1	1931-33	Wu
Lungyen (Fukien)**	38.4	46.3	1935	Yang
Canton	57.2	42.8	1931-33	Wu
Hongkong**	32.	41.	1909-23	Uttley

* Including the varieties rattus and alexandrinus.

** Other rodents were also collected but not included here.

TABLE 16

SEASONAL PREVALENCE OF THE IMPORTANT RAT-FLEAS

Locality	Species	Prevalence	Season
Tangku	X. cheopis	95.93	All year highest in June-Sept.
	M. anisus	4.07	Spring
Peiping	X. cheopis	98.	All year highest in Aug.
	M. anisus	2.	
Shanghai	X. cheopis	5.1	August - October
	M. anisus	19.2	March - May
	L. segnis	75.3	All year except August
Hankow	X. cheopis	62	All year - rare in spring and winter
	M. anisus	9	Spring
	L. segnis	16	Spring
Amoy	X. cheopis	70.19	All year - higher in summer.
	M. anisus	0.70	Nov - Dec
	L. segnis	27.99	All year - except summer months
Canton	X. cheopis	70	All year - highest in May and June
	M. anisus	5	Winter and spring
	L. segnis	25	Spring and winter
Hongkong	X. cheopis	94.2	
	L. segnis (?)	3.7	
	Ctenopsylla	1.2	
	Ctenocephalides	0.88	

CHAPTER VII

OTHER ARTHROPOD-BORNE DISEASES

Dengue fever. -- Case reports of dengue fever in China are meager. However, it is known that this disease appears periodically along the south China coast and spreads north during the summer. Faust (1929) stated that authenticated outbreaks which have temporarily disabled a large percentage of the population have been reported from Hongkong, Amoy, Formosa, and even as far north as Hangchow and Shanghai. Bassett-Smith (1923) reported eight cases from Hongkong in 1914 and Buddle reported a severe epidemic in the Canton Delta in 1928. The disease is also prevalent at Ko-chow, Kwangtung. As early as 1873, Manson reported the occurrence of the disease at Amoy. There have been epidemics in Ningpao and Hangchow of CHEKIANG PROVINCE (Nauck, 1928). According to Maxwell (1929), the disease is so infectious that 90 percent of the inhabitants of Hangchow were attacked in one epidemic. Tournier and Guénolé (1928) reported ~~14~~ 12 cases in an epidemic which occurred in the ~~Shanghai~~ Shanhaikuan garrison from the 4th to the 29th of February, 1928. In 1940 a severe dengue epidemic occurred in the Shanghai-Nantungchow area of KIANGSU PROVINCE. Sporadic cases have also occurred in Cheefoo in northern SHANTUNG and in southern MANCHURIA. Chtcherbakoff (1930) reported 23 cases in a period of 18 months in Kashgar of western SINKIANG PROVINCE. The disease is probably more common in China than these records would indicate, since its mosquito vectors, *Aëdes aegypti* and *A. albopictus*, are rather widely distributed. The former species has been collected from Amoy, Shanghai, Canton, Hongkong and Hainan Island while the latter is known from the Provinces of Kwangtung, Fukien, Chekiang, Anhwei, Kiangsu, Kiangsi, Hupeh, Shantung and Hopei, (Feng, 1938). Foochow had a dengue epidemic in the spring of 1944.

Aëdes aegypti (=*Stegomyia fasciata*) is cosmopolitan in its distribution between 40° north and 40° south latitude. More is known of its habits and biology than of any other mosquito. Its habits are apparently no different in China than elsewhere. Larvae can be found in all types of artificial accumulations of water even in minute volumes. Typical breeding places are rain barrels, tanks, cisterns, tin cans, urns, as well as water accumulated on leaves and in plant axils. It is almost exclusively a house mosquito and is rarely found more than 1,500 feet from habitations of some type or other. It is strongly anthropophilic. The younger adults are apparently daytime fliers until a meal of blood is secured and are thereafter nocturnal.

Aëdes albopictus, also regarded as a vector in China, has not been reported as frequently as *aegypti*. However, Feng (1938) describes it as a common mosquito in China. It breeds near dwellings, frequently in habitats similar to those of *Aëdes aegypti*. Larvae are found in water tanks, tin cans, cisterns, plant axils, rain barrels, etc., and rarely in ponds, ditches, and mud puddles. It is also strongly anthropophilic and its bite is more irritating than that of *aegypti*.

Yellow fever. -- Yellow fever has not been reported from China. However, because of the presence of its mosquito vector *Aëdes aegypti* in the southern provinces it is generally believed that if once introduced into the southern parts of the country it could become widespread.

Sandfly fever. -- Sandfly or pappatasi fever has been reported in Sinkiang Province. However there are no reports of the disease from the coastal provinces and no reason to assume that it occurs there.

Arthropod-borne encephalitides. -- Tick-borne encephalitis, transmitted by *Ixodes persulcatus*, has been reported from various areas in the far eastern parts of the U. S. S. R. As yet there are no records of its occurrence in China. Japanese B encephalitis now appears to be mosquito-borne, *Culex pipiens* and *Culex tritaeniorhynchus* being suspected as the vectors. Both these species occur in China. Chu et al (1940) and Huang and Liu (1940) described a small epidemic in Peiping that was thought to have been of the Japanese B type. No information was given concerning the mode of transmission. It is possible that the disease has a much wider distribution in China.

CHAPTER VIII

CHOLERA

Cholera has been known in China from time immemorial. Whether it actually originated in this country or was introduced from elsewhere at a very early date is an unanswered question. In this country the disease shares with plague the distinction of being a most serious epidemic disease and of the two it is more important in frequency and extent. The first modern authentic record of cholera in China is dated 1820, when a severe epidemic swept from the south to the Yangtze Valley. The disease has made its appearance almost annually with varying severity. There have been recorded numerous epidemics of which the most severe spread over most of the provinces including Manchuria. Table 17 shows the conspicuous cholera years in China indicating the northern extent of the epidemics. The high population density, favorable climatic conditions especially in the central and southern provinces, lack of adequate sanitary water supplies and other facilities, and lack of a well-organized and integrated public health service contribute to the cholera hazard in China. It should be borne in mind that this hazard is enhanced by war conditions.

A striking feature of cholera in China is that no regular epidemic periodicity can be detected. Years of epidemic prevalence alternate with a number of years of moderate incidence and years when it is entirely absent. The 1919 epidemic, estimated to have involved 300,000 cases, apparently began at Swatow where it was introduced from the Straits Settlements, and thence to Pootung where there were 2,000 cases in a short time. From July 5 to the end of July there were no less than 3,500 cases admitted to Shanghai hospitals.

In 1926, cholera was epidemic throughout eastern Asia, including China, Korea, Japan, Philippines, Indo-China, Thailand and India. South and central China were badly affected, serious outbreaks having been reported in almost every city in the Yangtze Valley including Nanking, Soochow, Wusieh, Huchow, Anking, Hankow, Wuchang etc., in addition to southern cities such as Foochow, Amoy, Swatow, Canton, Hainan, etc. In Shanghai district, there were at least 20,000 cases. In Manchuria, only 1,500 cases occurred in 1926 as compared with over 10,000 in the previous cholera year of 1919. There are no endemic centers in Manchuria, all outbreaks being traceable to importation from the south (Yang, 1928).

Following the Yangtze flood in 1932, cholera reappeared epidemically. This time the disease invaded 23 provinces and 312 large cities involving 100,000 cases and nearly 34,000 deaths (Wu et al). The epidemic area extended from Canton in the south to Sansing and Tsitsihar in north Manchuria, and from Foochow on the east coast to Ku-yuan in eastern Kansu. In the following four years from 1933 to 1936 only sporadic cases were reported from different parts of the country.

Table 18 shows the number of cholera cases reported from different hospitals in 1933 and 1934 while Table 19 gives the number of deaths due to the disease in certain large cities as reported by the respective municipal governments. The report of the First Health District of Peiping gives 51 cases and 40 deaths of cholera in 1932 and no case in 1933 and 1934. Chen (1936) reported a specific mortality rate of 12 per 100,000 population in Ting-hsien, Hopei in 1935. In Shanghai there have been many reports on the disease since 1932. Kuroya and Oshio (1932) reported that there were 4,103 cases from April to the third of September, 1932. According to the Central Cholera Bureau, Shanghai was free from Cholera for the four years prior to 1937.

Cholera in China since 1937. -- In 1937, due to conditions invoked by the Sino-Japanese War cholera again became epidemic in most of the large cities in China. The first case was reported in August in Shanghai. According to the report of Municipal Gazette of the Council for Foreign Settlement of Shanghai, the total number of reported cholera cases in the first outbreak (August 30 to October 6) was 1,173 with 341 deaths (Nishimura, 1938). Malval and Palud (1938) reported 1,787 cases and 347 deaths in the French Concession in 1937. In the first week in August, 1938 there were 960 cases with 213 deaths (C.M.J. 53:90, 1938). The epidemic expanded from the coastal provinces and spread to the interior involving 40,645 cases in nine provinces by the end of 1938. In 1939 it had spread as far west as YUNNAN, SZECHWAN, and SIKANG and as far north as SHENSI and KANSU. The number of cases in this year amounted to 34,945 in fourteen provinces. Available information seems to indicate that the disease has continued to be present

in more or less epidemic proportions in many places up to the present time. In HONAN it reached epidemic proportions during the migration years of 1939 and 1940. It also expanded as far northwest as Sianfu in SHENSI (C.M.J. 54:288, 1938). Numerous cases were reported from KIANGSI, HUNAN, HUPEH and SHENSI in 1939. In KWANGTUNG PROVINCE the first cases of the 1939 cholera epidemic were observed in Futshan at the end of April and in Canton at the beginning of May. The epidemic practically subsided by October 21. The total number of reported cases in Canton was 214 with 110 deaths (Kubota, 1941). The 1939 epidemic in YUNNAN was introduced by chauffeurs from KWEICHOW PROVINCE. In a period of five months from July to November 3, 486 cholera cases with 2,515 (74.2 percent) deaths were reported in the province, mostly from localities along the highways and railways. The disease spread to Kunming in July and reached its peak in the middle of September. In this city 436 cases were reported and with a case fatality rate of 63.2 percent (Pollitzer et al, 1941). In general, the epidemic was declining in 1940, a relatively large number of cases being reported in only four semi-isolated areas in CHEKIANG, FUKIEN-KWANGTUNG, HUNAN, and northern SZECHWAN. In 1941 it had subsided except in HUNAN, KWANGTUNG, and FUKIEN where there were 349 cases reported in 34 hsien. In 1942 the disease broke out again in the southern and southwestern provinces, By the end of September when the epidemic was gradually subsiding, 11,923 cases had been reported in 218 hsien of 12 provinces (King, 1943). In KWANGTUNG the disease first appeared in 1942 in February at Hok-shan and Sze-hui, probably having been imported from Hongkong or Canton. In April cases were reported from Shui-hsi near Kwang-chow-huan which was another portal of entry for the infection. Starting from Canton and its neighborhood, the disease spread along the East, North, and West Rivers and continued via the main roads of communication reaching Ho-yuan and Feng-shun in the east, Chu-chiang in the north and Wuchow in the west. From Kwang-chow-huan and Shui-hsi, the disease invaded Kwangsi and thence into KWEICHOW. The epidemic began in May in Hsia-kwan of YUNNAN PROVINCE and then follwed the Yunnan-Burma Highway to reach Kunming. From Kunming it spread in all directions, reaching the Kweichow border in June (King, 1943).

According to King, cholera has been endemic in HUNAN, KWANGTUNG, and possibly also FUKIEN for many years since sporadic cases have occurred in winter and spring in these regions, often developing into epidemics in the summer months.

Epidemiology. -- Fournier (1940) stated that cholera is probably endemic in Shanghai between epidemics citing as evidence certain cultural peculiarities which he was able to detect in the 1937 epidemic. Maxwell (1929) has pointed out that cholera usually starts in the south and spreads northward rapidly along the sea coast by the trade routes and more slowly along the inland lines of commerce. It has a second line of rapid advance inland by the great Yangtze River, which allows a quick approach by water to the center of China and thence to the extreme west. On the other hand Chun (1935) believes that cholera is endemic in the central Yangtze Valley, particularly in the Wuhan district in HUPEH. As for Shanghai, he was inclined to consider that the disease, although primarily introduced from without, is now endemic in the district. This view was partially shared by Robertson and Pollitzer (1939) who claimed that the cholera outbreaks in Shanghai were suspected to be imported from some unknown endemic focus in the mid-Yangtze basin. The observations which they made during the period from December 1937 to January 1939, present considerable evidence that the valley of Yuan River in HUNAN PROVINCE which flows into the Yangtze through Tungting Lake, is an endemic focus for cholera. The authors reported confirmation of the presence of true cholera vibrios in the river water samples and the continued existence of the infection through the winter months at both Changteh and Yuanling. They concluded that the widespread cholera epidemic occurring in the summer and autumn of 1938, first in HUNAN and later in adjacent provinces, was largely traceable to the Yuan River Valley. There was direct evidence of the importation of cholera to Changsha by travellers coming from Changteh and to the Hankow area in HUPEH by passengers from the Yuan River Valley. Case fatality rate is usually 40-50 percent. However rates as high as 80 percent have been reported among unhospitalized cases (Robertson and Pollitzer, 1939).

Seasonal distribution. -- Chun (1935) stated that both in the southern and central parts of China epidemics usually begin in August and extend into September or even October. Earlier outbreaks are rare; late appearance of the disease is exceptional. However, this statement does not hold true under the abnormal conditions. In Shanghai both the 1932 and 1937 epidemics began as early as April and in Kwangtung the first case in 1939 was also observed in April.

TABLE 17

CHOLERA EPIDEMICS IN CHINA*

Year	Northernmost points reached	Year	Northernmost points reached
1820	Yangtze Valley	1891	Korea
1821	Shantung Province	1892	Yangtze Valley
1822-24	"Chinese Tartary"	1895	Korea
1826-27	Mongolia & "Chinese Tartary"	1896	Yangtze Valley
1840	Mongolia	1902	Manchuria
1850	Ichang	1903	Shanghai
1858	Amoy	1907	Chili Province
1862	Manchuria	1908	Yangtze Valley
1863	Shanghai	1909	Manchuria
1864	Shanghai & Ichang	1910	Dairen
1865	Shanghai	1912	Yangtze Valley
1875	Shanghai	1913	Yangtze Valley
1877	Shanghai	1914	Yangtze Valley
1877	Newchwang	1915	Winchow
1878	Shanghai	1916	Shanghai
1881	Korea	1919	Manchuria
1882	Yangchow	1920	Yangtze Valley
1883	Manchuria	1921	Antung
1884	Newchwang	1922	Honan Province
1885	Shanghai & Ichang	1925	Yangtze Valley
1886	Korea	1926	Manchuria
1887	Shanturg	1929	Yangtze Valley
1888	Korea	1932	Manchuria
1890	Korea	1937	Shensi and Kansu

* From Chun (1934).

TABLE 18

HOSPITALIZED CASES OF CHOLERA IN 1933 AND 1934*

Hospital and Locality	Province	1933 No.	1934 No.
Mackenzie, Tientsin	Hopei		1
P.U.M.C., Peiping	Hopei	3	
St. Paul's, Kweiteh	Honan	1	
Christian, Hsüchowfu	Kiangsu	7	20
Red Cross, Shanghai	Kiangsu		
Lester, Shanghai	Kiangsu	4	1
University, Nanking	Kiangsu	5	1
Christian, Luchowfu	Anhwei		1
General, Wuhu	Anhwei	8	
Kwangshi, Hangchow	Chekiang	6	1
Union, Hankow	Hupeh	5	4
Methodist General, Hankow	Hupeh	1	1
Methodist, Wusueh	Hupeh	4	2
Bethesda, Siangyang	Hupeh		1
General, Changteh	Hunan	3	1
Hudson Taylor, Changsha	Hunan	21	6
Presbyterian, Hengchow	Hunan	6	1
Hope Hospital, Kulangsu	Fukien	1	2
Mission, Swatow	Kwangtung	29	12
General, Canton	Kwangtung	1	

* From Gear (1934,1936).

TABLE 19

DEATHS FROM CHOLERA IN CERTAIN LARGE CITIES IN CHINA

(Reported by the various Municipal Governments)

City	1931	1932	1933	1934	1935	Total
Tientsin	25	55	4	8	-	92
Peiping	?	164	22	3	-	189
Tsingtao	3	8	-	-	-	11
Shanghai	30	67	-	-	-	97
Nanking	25	359	12	-	-	396
Hangchow	20	548	5	2	-	575
Hankow	153	1,103	141	273	-	1,670
Canton	5	488	-	-	-	493

CHAPTER IX

DYSENTERY

The dysenteries have been recognized in China since 2000 B. C. and are among the most common diseases of that country. Both the bacillary and amebic types are widespread and are important causes of morbidity and mortality not only among the Chinese but among the foreigners as well. All statistical information for China on these diseases is subjected to the inherent fragmentary nature of communicable-disease reports in that country as well as to the variations in reliability of diagnoses and surveys. Many of the reports are undifferentiated as to type. Gear (1934,1936) in his surveys of hospital cases in 1933 and 1934 showed that this group of diseases was the cause of 1.2 to 1.4 percent of all hospital admissions for those years. There is a progressive increase from south to north in the percentage of dysentery admissions in hospitals (south China 1.1 percent, Yangtze region 1.3 percent, and north China 1.8 percent in 1934). King (1943) tabulated 101,686 reported cases of dysentery from free China in 1941. According to the Annual Report of the First Health District of Peiping, 1927, the specific death rate from dysentery was 87 per 100,000. This incidence is exceptionally high when compared with statistics from other parts of the world. In fact among all the communicable diseases in China, dysentery is perhaps the most important although the least heeded because it is so common. Of the two types, bacillary dysentery is more common. Scott et al (1938) made a survey of the disease incidence among Chinese children in six selected hospitals throughout China and reported that bacillary dysentery constituted 1.7 percent of the total cases, and amebic 0.5 percent.

Notes on the distribution and incidence of bacillary dysentery: -- In Pinchiang, the Chinese city of Harbin, Li n and Wu (1927) reported 104 cases of dysentery during the first six months of 1926 (population about 100,000). According to the infectious disease statistics from the Harbin Railway Area dysentery reaches its maximum in July (Chun, 1930). Kiao (1927) reported that the Circular Medical Service along the Taonan-Angangki Railway on the border of LIAONING and HEILUNGKIANG PROVINCES, treated 75 cases of dysentery from July 5 to July 28, 1926. In Mukden Hospital 313 cases of bacillary dysentery were treated from 1929 to 1933, representing 24 per 10,000 cases while the number of amebic cases were 10 per 10,000 during the same period (Taylor, 1935). Hiyeda (1935) reported that 307 dysentery patients were treated in the Manchuria Medical College Hospital 1933. They are classified as follows: bacillary 105, amebic 75, bacilli and amebae 21, and of unknown cause 106.

Tsuchiya and Nagata (1928) made a survey on dysentery in SOUTH MANCHURIA from 1917 to 1927. The case fatality during this period ranged from 10 to 16 percent. Cases occurred throughout the year with the highest incidence from May to September inclusive. Thirty-seven strains of dysentery bacilli were isolated in 1926 and 101 strains in 1927. They were classified as follows:

Year	No. of Strains	Reaction	Shiga Type	Y-Type	Flexner Type	Strong Type	Shiga Atypical III
1926	37	Fermentation	27.5%	11%	25%	-	3.1%
1927	101	Fermentation	14.2	53.4	18.7	2.9%	10.8
1927	101	Agglutination	?	23.7	33.6	-	10.8

Fecal examination was made on 60 cases of dysentery during the dysentery epidemic at Mukden in the summer of 1929 by Nakamura (1930). Dysentery bacilli were demonstrated in 44 cases. Among the 44 strains, 29 were Flexner type, 12 Y-type, and 3 Shiga. Hoshizaki (1928) reported that 1,220 cases of dysentery were treated in the Dairen Isolation Hospital during a period of ten years. The ratio of the two types, bacillary dysentery (including ekiri) and amebic dysentery, was 34 to one. The mortality rate was 54.9 percent for bacillary dysentery and 17.2 percent for amebic dysentery. The months of greatest frequency were July, August and September. Dysentery bacilli were isolated from the stools of 95 patients during the epidemic of 1927 and were classified by carbohydrate fermentation and indole reaction as follows: Shiga type 39.3 percent, Y-type 46.1 percent, Flexner type 5.6 percent, Strong type 5.6 percent, and mannite non-fermenters 3.5 percent. By agglutination reaction their classification was Shiga 39.3 percent, Y-type 53.9 percent and Flexner 6.8 percent.

In the First Health Area of Peiping (HOPEI PROVINCE) there were 181 cases of dysentery in 1931, 418 in 1932, 453 in 1933, and 270 in 1934. The numbers of deaths were 81, 144, 98, and 74 for the four years respectively, an average case fatality rate of 30 percent (Report of the First Health District of Peiping, 1935). The average death rate in the area in 1926 to 1932 due to dysentery was 46 per 100,000 population (Grant & Yuan, 1932). Yuan (1940) stated that comparing the high and low mortality years in the First Health District of Peiping one finds that dysentery, diarrhea, and enteritis together with scarlet fever are responsible for 65 percent of the extra mortality.

These intestinal diseasesare also the cause for 40 percent of the extra mortality in the years of mean mortality over those of low mortality. The excess of deaths from these intestinal diseases is distributed chiefly in the summer and autumn among children under 10 years of age. Chen (1936) reported a specific death rate for dysentery of 230 per 100,000 population in Tinghsien City and surrounding villages.

In Tsinan, SHANTUNG PROVINCE Gear (1934, 1936) listed 314 cases of dysentery from Cheeloo Hospital in 1933 and 335 cases in 1934. Scott et al (1938) reported 137 child cases of bacillary dysentery and 10 of amebic dysentery treated in the same institution from July, 1931 to June 1935. In Tsingtao there were 147 reported deaths due to dysentery from July 1933 to June 1934 according to the Shin-Pao Yearbook, 1935. Hirose (1929) reported that of 110 strains of dysentery bacilli isolated from the child patients in Tsingtao in 1928; 25.5 percent were of the Shiga type, 3.6 percent Schmitz, and 8.2 percent Flexner type.

In Shanghai dysentery is very prevalent. Billinghurst (1922) in reviewing the annual reports of the General Hospital at Shanghai for 50 years from 1870 to 1920 showed that the admissions for dysentery are more numerous than those of any other communicable disease. Table 20 shows the number of cases of dysentery treated in this institution and the case fatality rates for the different periods.

TABLE 20

SUMMARY OF DYSENTERY REPORTS FROM THE GENERAL HOSPITAL, SHANGHAI (1870 to 1920)

Years	No. Cases	Case Fatality Rate
1870-1880	249	18.5
1881-1890	192	13.5
1891-1900	348	8.6
1905-1911	691	5.4
1913-1920	936	2.7

Kuroya and Hong (1935) reported 718 cases and 177 deaths of the disease in 1930, 1,066 cases and 233 deaths in 1931, and 1,076 cases and 113 deaths in 1932. Dysentery was epidemic in 1933 and 1934. There were reported 1,427 cases and 182 deaths in 1933 and 1,811 cases and 252 deaths in 1934. The average case fatality rate for the five years was 15.7 percent. The distribution in Shanghai for these five years is shown in Table 21.

In the Country Hospital, Shanghai 109 cases of dysentery were reported in 1937, representing 14.4 percent of all admissions. Kuroya and Hong (1935) collected and classified 139 specimens during the epidemic of 1933. Of this total 28 (21.1 percent) were Shiga type, 76 (54.7 percent)Flexner Y, 21 (15.1 percent) Schmitz, 4 (2.9 percent) Ohara, and 10 (7.1 percent) were coli bacillus. Hong and Ono (1935) isolated 120 strains of dysentery bacilli in Shanghai during the epidemic of 1933 and classified them as follows: Shiga 29 percent, Schmitz 2.5 percent, Flexner Y (metadysenterie A and metadysenterie B) 56.7 percent and paradysenterie 3.3 percent. The findings of both of the two series indicate that Flexner bacillus is the most common type in this area and that Shiga ranks the second. Davis (1923) found that out of 47 strains, 14 were Flexner and three were Shiga.

In Nanking, Yang and Wei (1937) reported 242 dysentery cases with 30 deaths in 1936. The Municipal Hospital of Infectious Diseases listed 159 cases with one death treated in 1933, 179 cases with 12 deaths in 1934, and 45 cases with 10 deaths in 1935.

In KIANGSI PROVINCE epidemics of dysentery have appeared almost annually since 1928. Many thousands of cases and deaths were reported during the summer of 1934. Yang and Sung (1936) made a series of laboratory examinations during the severe epidemic in 1934-1935. Altogether 2,674 persons were examined, including 1069 dysentery patients, 1066 malaria and other patients, 277 apparently healthy hospital orderlies, and 262 apparently healthy students. The results of this study are given in Table 22.

TABLE 22

RESULTS OF EXAMINATIONS OF VARIOUS GROUPS OF PERSONS FOR BACILLI IN KIANGSI PROVINCE

Clinical Group	No. Examined	Shiga No.	Shiga %	Flexner No.	Flexner %	Total	Percent
Dysentery Patients	1,069	40		106		146	13.7
Malaria & Other Patients	1,066	42		70		112	10.5
Healthy Hospital Orderlies	277	3		12		15	5.4
Healthy Students	262	4		17		21	8.0
Total	2,674	89	3.3	205	7.7	294	11.0

In southern China dysentery is not prevalent as in the north. Gear (1936) recorded only 47 cases out of a total hospital incidence of 5,905 in the Union Hospital in Foochow of FUKIEN PROVINCE in 1934. However, Hemenway (1934) stated that dysentery is so prevalent during the summer months at Mintsing and so frequently fatal that the local people are very frightened upon hearing this diagnosis.

The Canton Municipal Sanitary Bureau (KWANGTUNG PROVINCE) reported 334 cases in 1924 (Katahira, 1926). In the Hainan Island, Bercovitz (1935) stated that both bacillary and amebic dysentery are found and at times are very serious. Bacillary dysentery is more prevalent in places where people have been away from the island while amebic type is more prevalent among people who have never been away from Hainan.

In the southwestern parts of China Gear (1936) reported 279 cases out of 17,439 admissions to C.S.M. Hospital at Yunnanfu (1.6 percent of all admissions). Tucker (1937) stated that before 1934, dysentery was practically unknown in northwestern KWEICHOW PROVINCE but now it is a scourge. He reported 25 cases of amebic dysentery encountered within eight months in the Missionaries' Memorial Hospital at Chao-tung of northeastern Yunnan but mentioned that no cases of bacillary dysentery were observed in his 13 months of residence at Weining-hsien.

Bacillus dysenteriae bacteremia. -- Scott (1938) reported one case of dysentery bacillemia in Tsinan. Two cases, one Shiga and the other of a mannite fermenting group, were reported from Shanghai by Ling (1940). According to this author the number of cases of this disease is small in China.

Incidence of amebic dysentery. -- In most of the data on dysentery in China the types of the disease, bacillary or amebic, are not differentiated and therefore, it is not possible to present a clear picture of the relative prevalence of the two types of the disease. As elsewhere bacillary dysentery is more typically an epidemic disease whereas amebic dysentery is usually endemic. In some parts of the country the bacillary type is much more prevalent while in others the reverse is true and in still others the relative prevalence of the two types varies with different years. Table 23 shows the reported cases of dysentery in children in six hospitals. (Scott, Pi and Lair, 1938).

TABLE 23

	Period	Bacillary	Amebic	Unclassified
Mukden Med. Coll. Hospital	1932-35	95	160	-
P. U. M. C. Hospital, Peiping	1930-35	217	6	-
Cheeloo Hospital, Tsinan	1931-35	137	10	-
Central Hospital, Nanking	1933-36	72	2	1
Nat. Med. Coll., Shanghai	1932-35	152	6	-
Canton Hospital	1931-35	34	5	15

Taylor (1935) reported that 130 cases of amebic dysentery were treated in the Mukden Hospital from 1929 to 1933 whereas 313 cases of bacillary dysentery were treated in the same period. According to Hiyeda (1935) the Manchuria Medical College Hospital treated 96 cases of amebic dysentery against 126 cases of bacillary dysentery in 1933. Chang, Chen and Chou (1936) reported that in the years 1930-1935, 75 cases of amebic dysentery were admitted to the P. U. M. C. Hospital, whereas in the same period 759 admissions were for bacillary dysentery. Because of the chronic nature of amebic dysentery hospital admissions do not constitute a reliable index of its prevalence. In Shanghai Davis (1923) made microscopical examinations of 234 dysentery cases. Endamoeba histolytica was found in 13 and E. coli in two. In the International Settlement there were reported 346 cases of dysentery among the Europeans in 1930. Of these 148 were amebic dysentery and 198 bacillary dysentery.

During the dysentery epidemic of 1934-1935 in Kiangsi, Yang and Sung (1936) examined 65 stool samples of dysentery patients for Endamoeba histolytica: only two were found to be positive.

On Hainan Island, as mentioned above, bacillary dysentery is more prevalent in places where people have been away from Hainan and the amebic type more among people who have never been away from the island. In some parts of southwestern China along the Yunnan-Kweichow border amebic dysentery is particularly prevalent while the bacillary dysentery is rare.

Surveys consisting of systematic stool examinations have been made in various parts of the country and invariably reveal a high rate of amebiasis due to Endamoeba histolytica. It is interesting to note that there is apparently a higher rate of infection in northern China than exists in the central and southern provinces. Faust (1929) reported a histolytica-infection rate of 15.2 percent among 13,617 persons examined at the Peiping Union Medical College. Tao (1931) reported a rate of 45 percent among 9,533 hospital patients in Peiping. This was based on an average of 3.8 examinations per person.

Winfield and Chin (1939) conducted single smear examinations of 4,618 stools from eight population groups in the rural and urban communities, ~~in~~ Tsinan area, Shantung, and reported an average histolytica-infection rate of 13.8 percent. Rate for the rural group was 25.3 percent, one of the highest to ever be reported in the literature. Chang (1939) examinded normally passed stools from 27 butchers in Tsinan and found eleven with Endamoeba histolytica.

In west central SHANSI, Curran and Feng (1930) made 2,804 examinations on 1,135 individuals for intestinal protozoa. The corrected histolytica rate was 15.0 percent.

Little information is available regarding the conditions in the northwestern provinces. Taylor (1931) reported on the examination of stools of 92 cases at Lanchow, Kansu, April, 1931. The majority of the cases were examined once and only a few were examined twice. The histolytica-rate in this series was 5.4 percent. Hsu (1943) surveyed seven localities in northwest China, Ningkiang, Paocheng, And Sian in the province of SHENSI; Tienshui, Lanchow, and Pingling in the province of KANSU; and Sining in the province of TSINGHAI. Altogether fecal examinations were made for 720 persons. The histolytica-rate was found to be low in all three provinces, the highest being 2.4 percent at Sian and Tienshui. The direct-smear iodine

stain was used in the examination which, according to Faust, is about one-third as reliable as the use of any other diagnostic method. Therefore, the incidence of E. histolytica in this region is probably about eight percent. This scanty information may indicate that a comparatively low incidence of E. histolytica exists in the northwest part of the country.

In Shanghai, Andrews (1938) conducted a survey of intestinal parasites in Chinese hospital patients. In this survey examinations of 5,205 fecal specimens from 2,888 cases were made with an average number of 1.8 examinations per patient. Of the total individuals examined, 126 (4.3 percent) were found to have E. histolytica. Chu and his co-workers (1936) examined 914 persons, mostly school children, at Kao-chiao near Shanghai and found only 0.2 percent of them infected (one examination per person). When corrected to six examinations the infection rate was 0.5 percent. In Nanking, Yao, Hsu and Ling (1935) examined 2,877 primary school children, 1,408 students of the military academy, and 5,568 patients in the University Hospital and found histolytica-rates of 1.43, 4.0 and 0.6 percent respectively. This is in contrast with the results of Winfield and Chin (1939) in Tsinan area where 12.5 percent of 700 urban school children and 11.8 percent of 965 rural school children were found to have histolytica. Yao and Chu (1935) examined 1,365 persons at Tángshan 20 miles east of Nanking and reported that less than one percent harbored histolytica. Andrews(1933) made routine fecal examinations on 632 patients in Hankow, 913 examinations being made and found that 97, (15 percent) were positive. Faust and Wassell (1921) made routine examinations on 359 patients at Church Central Hospital in Wuchang in a period of six months and found only 2.5 percent positive whereas intensive examinations on 57 patients in the same hospital showed 50.9 percent positive (Faust,1924). Further west in western SZECHWAN PROVINCE, Williams (1940) made a fecal survey in a rural area on and around Mount Omei during the months of July and August, 1938. Examinations were made on 619 persons by cover slip examinations. E. histolytica cysts were found in 36 persons and the trophozoites in six. He also gave the results of the physical examinations of the students in West China Union University for 1936-1938. A total of 765 examinations (one examination by cover slip preparation for each student) revealed an average histolytica-rate of 5.8 percent. The ratio of cysts to trophozoites was 5 to 0.8 percent, approximately the same as in the rural series. Chang and Lin (1940) examined fecal samples from 1,578 hospital patients, 457 school children, 241 soldiers, and 66 "old people" in Chengtu and its vicinity and reported the rates for E. histolytica as 6.3, 0.9, 9.1 and 1.5 percent respectively.

In south China, Faust and Kellogg (1929) made a survey of the parasitic infections in the Foochow area (FUKIEN PROVINCE) and noted the small number of species and low incidence of intestinal protozoa in this region. Two rice-growing villages showed 7.6 percent and 12.0 percent histolytica-rates whereas two mulberry growing villages had the incidence of 3.0 percent and 1.0 percent and three mountain villages had the incidence of 3.3, 3.6 and 3.3 percent. The annual reports of the clinical laboratory of Canton Hospital for the years 1930-1931 to 1934-1935 inclusive, report that only 20, (0.4 percent) of 4,585 routine stool examinations were positive (Winfield and Chin, 1939). Lin and Yao (1936) reported that 0.4 percent of 823 persons examined at Kweiyang in KWEICHOW PROVINCE, and 1.8 percent of 275 persons from Ko-chiu, of YUNNAN PROVINCE, had the histolytica-amebiasis. The examinations of 98 persons from Ning-erh and 88 persons from Szu-mao, both in YUNNAN PROVINCE, were negative.

From all this evidence it seems clear that the incidence of Endamoeba histolytica in north China is higher than that in the central and southern parts of the country. Winfield and Chin believed that vegetables and fertilization of vegetables do not play a critical role for this difference, but some other quantitatively more important factors are responsible for this situation. Night soil is used in both the north and south for fertilizing vegetables. Should this practice be a critical factor for the spread of the parasite the situation would be reverse in the two parts of China for human excrement is generally used dry in the north and wet in the south. These authors believed that the food habits may be the basis for the difference in amebic carrier rates in the different parts of China. In north China people consume a large amount of cold bread stuffs which may be subject to contamination, while in central and south China a great deal more rice is eaten and this is mostly served hot and is not handled with the hands.

The compound incidence of Endamoeba histolytica, Endamoeba coli, and Endolimax nana has been considered to be a more stable measure of the true incidence of intestinal protozoa for comparative purposes than is the incidence of any single species. Table 24 shows the compound incidences of these three species from single-examination surveys with single-examinations in various areas. This further indicates higher incidence in the north and lower incidence in the south.

OTHER INTESTINAL PROTOZOA

In 1923, Wassell reported a case of Isospora hominis in the clinic of the Church General Hospital in Wuchang. The parasite was recovered from a farmer patient who stated that he had never been away from home further than Wuchang, 25 miles from his native place. Faust and Lo (1928) reported another case from the Peiping Union Medical College in September, 1927. The patient gave a history of chronic diarrhea. Cysts of both the one-celled and two-celled stage were found to be common in the feces. Only four cases of Balantidium infections are found in literature from China. One was reported by McCartney (1910) from Chungking, two by Wright (1914) from Takhing and one by Liu (1941) from Chefoo, Shantung.

A complete enumeration of the casual and doubtful protozoan infections reported from China is beyond the scope of this treatise. See Appendix I for data of other intestinal protozoa.

DIARRHEA AND ENTERITIS

Food contamination, water pollution and other unsanitary condtions in China are the cause of a high rate of various diarrheas and enteritis. For example, Grant and Yuan (1932) gave a specific average death rate of 110 per 100,000 population for diarrhea and enteritis in children under two years of age in the First Peiping Health District (1926-1932). Chen (1936) gave a specific death rate of 200 per 100,000 population among children under two in Ting-hsien for 1935. Gear's hospital surveys of 1933 and 1934 show an incidence of these enteric diseases of from 0.31 percent to 3.26 percent of all the hospital admissions. There were reported 2,939 deaths from these diseases in Peiping from 1932 to 1935 and 3,548 in Nanking, 1,437 in Hankow, and 1,597 in Canton from 1931 to 1935.

TABLE 21

DYSENTERY IN SHANGHAI
IN 1930 - 1934

		1930	1931	1932	1933	1934	Total
International Settlement	Cases	250	686	880	1,054	1, 399	4,269
	Deaths	125	154	90	145	200	714
French Concession	Cases	202	216	145	118	156	837
	Deaths	39	63	20	24	26	172
Shanghai City	Cases	266	164	51	255	256	992
	Deaths	13	16	3	13	26	71
Total	Cases	718	1,066	1,076	1,427	1,811	6,098
	Deaths	177	233	113	182	252	957

TABLE 24

COMPOUND INCIDENCE OF ENDAMOEBA HISTOLYTICA, ENDAMOEBA COLI AND ENDOLIMAX NANA IN VARIOUS PARTS OF CHINA*

Author	Country or Region	Composition of Population	No. Examined	Compound Incidence
Winfield	North China	Rural family (1st)	671	27.0
Winfield	North China	Provincial soldiers	393	19.1
Winfield	North China	Rural family (2nd exam.)	670	18.2
Kessel and Svensson (1924)	North China (Peking)	Chinese population	816	18.1
Winfield	North China	City family	545	17.1
Winfield	North China	Tung Chia Chuang primary school	965	15.3
Winfield	North China	Primary school children	700	14.9
Winfield	North China	University students	216	13.4
Kessel and Svensson (1924)	North China (Peiping)	Foreign residents	221	12.8
Winfield	North China	Provincial School of Dramatics	133	9.3
Yao et al (1935)	Central China (Nanking)	Military Academy Students	1,408	9.0
Winfield	North China	Hospital Patients	325	8.1
Yao et al (1935)	Central China (Nanking)	Primary School students	2,877	6.6
Chu et al (1936)	Central China (Shanghai)	Rural residents mostly school children	914	5.9
Yao et al (1935)	Central China (Nanking)	Hospital patients	5,568	3.1

* From Winfield and Chin (1939) based on single examinations.

CHAPTER X

TYPHOID FEVER AND PARATYPHOID FEVER

The typhoid-paratyphoid group of enteric disease is an important cause of morbidity and mortality in China. Not only are they diseases of the large coastal cities but also of the remote country towns. Because these diseases are often unrecognized and untreated and further because a majority of the patients tend to visit the native physicians statistics do not reveal their actual incidence. The prevalence of these diseases is due largely to the lack of sanitary facilities and hygienic water supplies. Gear's (1936) survey of Chinese hospitals shows that the typhoid-paratyphoid group accounted for 0.6 percent of all hospital cases in 1934. Hsu and Ke (1937) in a survey of 19 communicable diseases in China collected data from 204 cooperating hospitals throughout the country. Of a total of 29,468 cases of communicable diseases investigated, typhoid and paratyphoid fever accounted for 3,276 (11.1 percent). The Chinese Ministry of Information (China Handbook, 1943) reported 15,218 cases of typhoid fever in the provinces of China in 1941, the incidence being second only to malaria among the communicable diseases. The greatest number 3,748, occurred in Honan Province, the next, 2,409, in Kwangtung. There were 1,452 cases in Kwangsi and 1,413 cases in Shensi. Winfield (1937) stated that typhoid fever and paratyphoid fever are very widespread and are only slightly less important than dysentery in north China. Grant and Yuan (1932) reported that the average death rate for typhoid fever in Peiping from 1926-1932 was 20 per 100,000 and Chen (1936) reported a specific death rate of 25 per 100,000 for these diseases in Tinghsien in 1934. Yao, Yuan and Huie (1929) stated that the specific death rate from typhoid fever was 31 per 100,000. The widespread occurrence of typhoid and paratyphoid fever together with the constant cholera hazard emphasize the extreme importance of the use of proper precautions in the procurement and maintenance of water supplies.

Geographic notes on typhoid fever and the paratyphoid fevers in China. -- It is obvious from Tables 25 and 25A that these diseases are not peculiar to any particular part of China but rather appear at the present time to be endemic in all parts of the country. In Gear's reports for the years of 1933 and 1934 the highest incidence is found in the coastal cities such as Nanking, Shanghai, Foochow, and Kulangsu. However, such inland cities as Nanchang and Yunnanfu (Kunming) also report high rates. According to the data obtained by Hsu and Ke (1937) typhoid fever and the paratyphoid fevers are about four times as prevalent in central China as they are in north China and five times as prevalent in south China as they are in north China.

In the city of Harbin and its vicinity (central MANCHURIA) Kung (1928) reported 116 typhoid cases in 1927. Taylor (1935) reported that the proportion of typhoid fever cases treated in Mukden Hospital from 1929 to 1933 was 100 per 100,000 hospital cases while that of paratyphoid fever cases treated during the same period was three per 100,000. Zia (1928) gave the percentage of typhoid and paratyphoid fevers in the total admissions to the Peiping Union Medical College Hospital (HOPEI PROVINCE) in a period of six and one-half years as 1.4 percent. These diseases are also common in Tientsin and Paotingfu. In Tsingtao and Weihaiwei (SHANTUNG PROVINCE) numerous cases of typhoid fever and paratyphoid fever have been reported. In Shanghai there were 3,190 deaths due to the typhoid and paratyphoid fever reported to the Municipal Government in the period of 1931-1933, an average of 6.3 percent of the deaths due to all causes during that period. In the city of Nanking 408 typhoid cases with 143 deaths were reported by various sources in 1936. In the Municipal Hospital of Infectious Diseases in that city 250 cases of typhoid with 37 deaths were recorded in 1933-35 while only three cases of paratyphoid were treated in the same period (Yang and Wei, 1937). In the Shin Pao Yearbook (1935) the number of deaths due to typhoid and paratyphoid fever was given as 380 from July 1933 to June 1934. Pan (1935) of St. Andrew's Hospital at Wusih, a city between Shanghai and Nanking, reported 268 cases of typhoid and paratyphoid treated among the inpatients in a period of seven years, 2.6 percent of all hospitalized cases.

In Hangchow of CHEKIANG PROVINCE 1,153 deaths due to typhoid and paratyphoid fevers were reported in 1931, 1,003 in 1932, and 1,078 in 1933 (municipal government reports). Total deaths from all causes in the three years were 19,009 of which typhoid and paratyphoid fever caused 17 percent. From the stool examination of 2,674 sick soldiers and apparently healthy persons during a severe dysentery epidemic in 1934-1935 in KIANGSI PROVINCE, Yang and Sung (1936) found that 102 (3.8 percent) were carriers of paratyphoid bacilli and 13 (0.5 percent) were carriers of Eberthella typhosa. The Hankow Municipal Government reported 1,832 deaths from typhoid and paratyphoid fevers from 1931 to 1933. These represent 6.3 percent of all the deaths in the three years.

The Chinese Year Books (1936-1937, 1937) give the following typhoid and paratyphoid data for Amoy, Swatow, and Canton for 1935 and 1936:

		Jan.-Mar.	April-June	July-Sept.	Oct.-Dec.	Total
Amoy	1935	3	3	29	41	82
	1936	31	-	21	17	69
Swatow	1935	4	7	38	40	89
	1936	36	27	61	43	167
Canton	1935	43	49	249	188	529
	1936	48	80	275	181	584

Bercovitz (1935) reported that typhoid fever was an increasingly prevalent disease on Hainan Island.

Seasonal incidence of typhoid and paratyphoid fevers in China. -- Despite the wide variations in climate in different parts of China typhoid and paratyphoid fever seem to have similar seasonal distributions throughout the country. They occur throughout the year but have the highest incidence in the months of July to October and the lowest incidence from January to April. According to the infectious disease figures from the Harbin Railway Area typhoid fever there reaches its maximum in September (Chun, 1930). Smyly (1920) stated that the maximum occurred chiefly in the autumn in Peiping. Zia (1928) studied 256 cases of typhoid fever admitted to the Peiping Union Medical College Hospital for a seven year period and reported that very few cases occurred in the winter and early spring, but beginning in June there was an increase which reached its peak in September and declined to a negligible number in December. Wylie (1930) showed that of the 200 cases studied at Paotingfu 52.5 percent occurred in the months of September and October. No cases were admitted in February and March in eleven years. Pan (1935) made a statistical study of 268 cases of typhoid and paratyphoid fevers in St. Andrew's Hospital, Wusih (1928 to 1934) and reported that the number of cases increased steadily from May with its peak in August and reached the minimum from February to April. Huizenga (1923) of Nanking University Hospital reported the highest incidence there to be in May and September.

Relative incidence of typhoid and paratyphoid fevers in China: -- In many hospitals in China where the facilities for refined laboratory diagnosis are lacking, typhoid and paratyphoid fevers are considered as one disease or as one inseparable group of diseases and thus are reported unclassified. Consequently the relative incidence of typhoid fever and the paratyphoid fevers is not well known. Concerning the various types of paratyphoid organisms virtually nothing is known with the exception of the report by Wu and Zia (1935) which is discussed in a subsequent paragraph. Maxwell (1929) stated that among hospitalized cases there were about nine times as many typhoid as paratyphoid cases although he further pointed out that this did not indicate the true ratio. In the Mukden Hospital over a period of five years (1929-1933) the ratio of typhoid to paratyphoid cases treated was more than thirty to one (Taylor, 1935). Zia (1928) at Peiping Union Medical College Hospital reported 256 cases of typhoid were admitted to the hospital in a seven years' period compared to 48 cases of paratyphoid B fever admitted during the same period. Chu and Tso (1930) gave the following relative frequency of typhoid and paratyphoid fevers treated in the same hospital from 1921 to 1929.

	Adolescents and adults		Children under 12 years	
	No. cases	Percent	No. cases	Percent
Typhoid fever	344	83.7	41	63.1
Paratyphoid A	55	13.4	12	18.5
Paratyphoid B	12	2.9	12	18.5
Total	411		65	

In the latter two series the proportion of typhoid and paratyphoid compares favorably with Maxwell's statement. Wu and Zia (1935) made an extensive study on the Salmonella infections in man. The material for their study was taken from case records in the Peiping Union Medical College Hospital from 1921 to 1935. Practically all the cases reported have had bacteriological and serological confirmation in addition to the typical clinical diagnosis. In this period of fourteen years 691 cases of typhoid-paratyphoid group fevers were admitted to the hospital. There were 581 cases of typhoid, 65 cases of paratyphoid A, 22 cases of paratyphoid B, and 23 cases of paratyphoid C. This high incidence of paratyphoid A differs from the statement made by Maxwell (1929) who stated that of the paratyphoid group the large majority of the cases are paratyphoid B whereas paratyphoid A is uncommon. According to Wu and Zia paratyphoid A is primarily a disease of late childhood and early adult life. Eighty percent of the cases occurred in the second and third decades of life and no case was below one year of age. Paratyphoid B is more a disease of childhood. Paratyphoid A is a disease of summer and autumn whereas paratyphoid B occurs only in the warm months in this city. No case of the former occurred from January to May and no case of the latter occurred from November to May.

In Kiangsi, Yang and Sung (1936) found, in stool examinations of 2,674 individuals, Salmonella paratyphi (paratyphoid A) in 22 cases, Salmonella schottmülleri (paratyphoid B) in 80 cases, and Eberthella typhosa in 13 cases.

Other salmonelloses: -- In addition to paratyphoid A and paratyphoid B other Salmonella infections have also been reported from China. However, the information regarding these infections is so meager that no estimate of their prevalence can be made. Paratyphoid C has been reported only a relatively few times. Hicks and Robertson (1927) reported that in Shanghai in 1,583 Widal reactions, nine which were negative to typhoid and paratyphoid A and B agglutinated Salmonella suipestifer (paratyphoid C) to a titre of 1:30 or more. Blood and stools of two of the nine patients were examined. From one of these an organism was isolated by blood culture which appeared to be Salmonella suipestifer. In the Peiping Union Medical College Hospital, Tenbroeck, Li and Yu (1931) reported five cases in which organisms belonged to the paratyphoid C group. In four of these cases the organisms were considered to be secondary or terminal invaders. Wu and Zia (1935) reported 18 additional cases of paratyphoid C infection from the same hospital. The authors stated that seven of the 18 cases were primary infections.

Infection with Salmonella enteritidis is apparently rather rare. Li and Ni (1928) reported a case from the Peiping Union Medical College Hospital. The diagnosis was made by serologic tests as well as by isolation of the organisms from the blood, urine, feces, and saliva. Two more cases with one recovery were described from the same hospital by Wu and Zia (1935). Huang, Chang and Lieu (1937) studied 17 cases of S. enteritidis septicemia all of which occurred in Peiping. Nine of the 17 cases were associated with relapsing fever. Liu (1938) isolated 23 strains of S. enteritidis from patients, guinea-pigs, and human body lice infected with the organism in Peiping. In Shanghai, Tang (1933) reported two cases of this infection in 1933.

TABLE ~~24~~ 25

HOSPITAL CASES OF TYPHOID AND PARATYPHOID FEVER, IN 1933 AND 1934*

Hospital and Locality	Province	1933		1934	
		Cases	%	Cases	%
Mackenzie, Tientsin	Hopei	21	1.3	39	0.15
PUMC, Peiping	Hopei	43	0.78		
Taylor, Paotingfu	Hopei			35	0.56
Cheeloo, Tsinan	Shantung	29	0.23	42	0.63
Menzies, Hwaiking	Honan				
St. Paul's, Kweiteh	Honan	4	0.07	21	0.33
Christian, Suchowfu	Kiangsu	14	0.16	19	0.13
Red Cross, Shanghai	Kiangsu	147	1.84		
Lester, Shanghai	Kiangsu	177	0.39	187	0.32
Nat. Med. College, Shanghai	Kiangsu				
University, Nanking	Kiangsu	189	1.01	257	1.30
Central, Nanking	Kiangsu				
Christian, Luchowfu	Anhwei			27	0.44
General, Wuhu	Anhwei	34	0.67	50	0.83
General, Nanchang	Kiangsi	119	1.39	135	1.38
Kwangchi, Hangchow	Chekiang	142	0.76	118	0.61
Union, Hankow	Hupeh	70	0.95	61	0.65
Methodist General, Hankow	Hupeh	8	0.14	9	0.17
Methodist, Wusueh	Hupeh	13	0.76	5	0.22
Methodist General, Teian	Hupeh			6	0.22
Bethesda, Siangyang	Hupeh	2	0.12	3	0.08
General, Changteh	Hunan	24	0.45	25	0.34
Hudson Taylor, Changsha	Hunan	64	0.67	23	0.38
Presbyterian, Hengchow	Hunan	18	0.23	30	0.47
Union Hospital, Foochow	Fukien			100	1.69
Hope Hospital, Kulangsu	Fukien	49	2.11	57	2.74
Mission, Swatow	Kwangtung	103	0.94	70	0.69
General, Canton	Kwangtung	70	0.75		
Canton Hospital, Canton	Kwangtung			75	1.03
C.M.S., Yunnanfu	Yunnan	153	1.00	232	1.33

* From Gear (1934, 1936).

TABLE 25 A

REPORTED DEATHS DUE TO TYPHOID AND PARATYPHOID FEVER IN CERTAIN LARGE CITIES IN CHINA*.

	1931	1932	1933	1934	1935	Total
Tientsin	125	121	93	99	22	460
Peiping		371	132	48	68	619
Tsingtao	23	19	29	20	36	127
Shanghai	1,428	700	1,062	1,161	861	5,212
Nanking	484	352	460	306	167	1,769
Hangchow	1,153	1,003	1,078	1,086	99	4,419
Hankow	567	820	445	488	312	2,632
Canton	145	104	116	64	119	548

* From the Statistical Abstract of the Republic of China, 1935, 1940.

CHAPTER XI

TUBERCULOSIS AND THE ACUTE RESPIRATORY DISEASES

Tuberculosis is one of the most serious menaces to public health in China and is the most widespread of the infectious diseases. It is estimated that no less than 35,000,000 people in China have some active form of tuberculosis. The mortality rate is probably ten times as high as in the United States. According to Chen (1936) the specific death rate from tuberculosis in Ting-hsien in 1935 was 224 per 100,000 population. The report of the First Health Area of Peiping gives an average annual death rate of 318 per 100,000 from tuberculosis in the five years ending 1931 while the Bureau of Public Health, City Government of Greater Shanghai, gives an average annual death rate of 244 per 100,000 for four years ending 1932 (Li, 1934). Uttley (1938) reported the standardized death rate from tuberculosis for the years 1921 and 1931 in Hongkong as 430 and 422 per 100,000 population respectively. Hospital surveys throughout the country reported by Gear (1934, 1935) show that during 1933, out of the total of 190,475 patients in 16 hospitals 9,149 (4.8 percent) were diagnosed as tuberculosis and of these 5,992 cases were tuberculosis of the respiratory system and 3,157 were of non-respiratory types. Respiratory tuberculosis forms 48.1 percent of all tuberculosis in north China as compared to 70.9 percent in the Yangtze region and 58.6 percent in south China. The results of his survey for 1934 compares closely with that of 1933. Of 266,509 patients in 25 hospitals 4.8 percent had tuberculosis.

Chun (1928) stated that from south to north the proportion of non-pulmonary tuberculosis increases. In Hongkong 32 percent of tuberculosis cases were non-pulmonary 37 to 58 percent in Shanghai, 33 percent in Tsinan, 59 percent in Peiping, and 82 percent in Harbin. It appears that the cold and dry climate in the north has an influence on the prevalence of the non-pulmonary forms and that the hot and damp climate in the tropics favors the pulmonary form of tuberculosis.

A great deal of information is to be found in the literature relative to the various tests for tuberculosis in different regions and among different groups of people. Space allotted here permits the presentation of the results of only a few recent surveys. Woo (1940) gave Mantoux tests to 4,776 infants and children of lower and middle classes in Peiping. Of these 2,291 (48 percent) reacted positively. The number of children having a positive reaction increased with age. Positive reactions occurred in 12.8 percent of the children tested in their first year. The percentage of positive reactors increased gradually until in the twelfth year it was 80.7 percent. Opie (1939) reported that of 15,431 Chinese patients treated in the Peiping Union Medical College Hospital, 8 percent had pulmonary tuberculosis, whereas of 3,548 non-Chinese patients, only 1.6 percent had the disease. Of 331 intracutaneous tuberculin tests made on adult Chinese of the artisan class 94.3 percent reacted to 0.1 mg. of tuberculin. Chiu, Ho and Li (1940) studied the incidence of tuberculosis infection and pulmonary tuberculosis among 8,282 Chinese, mostly students, in Peiping and concluded that about 30 percent of the children from 5-6 years of age are infected; 60 percent from 10-11 years of age; 85 percent from 15-16 years of age; and, about 100 percent in the 20th year. The rate of infection is considerably higher among the urban populations than among the rural groups. Calcified nodules in the lung parenchyma were found in 17-30 percent of the tuberculin reactors. In both sexes there was an increment in incidence with increasing age.

Tung and Wong (1940) stated that 26 percent of the milk cows tested in Peiping reacted positively to the tuberculin test. Cattle of foreign breeds showed an infection of 27.7 percent while those of Mongolian type only 7 percent.

Wylie (1935) studied 600 junior middle students in Paotingfu to determine the incidence of tubercular infection and found that 85.5 percent of them reacted positively to the Mantoux tuberculin test. Fluoroscopic examination revealed pathological chest findings in 8.2 percent of the 488 positive reactors examined, (6.6 percent of the entire group). Scott (1943) compared the tuberculin tests made on two groups of Chinese children in Tsinan. A total of 2,931 city children received intradermal 0.1 mgm. old tuberculin test and 43.2 percent showed positive reactions while of the 1,787 country children similarly tested 43.3 percent were positive reactors.

In Shanghai, Kao (1940) reported the results of the Mantoux tests with a dose of 0.1 mgm. old tuberculin given to 2,521 children and infants. The percentages of infection were as follows: under 4 years, about 10 percent; from 5 to 9 years, about 52 percent; and from 10 to 14 years, about 69 percent. The average rate was 61 percent. The records of 12,453 patients in Soochow Hospital show a percentage of 10.6 with diagnosis of tuberculosis. The infection was the primary diagnosis in 85 percent of the tuberculosis cases (Sun and Thoroughman, 1939). Oldt (1933) stated that non-pulmonary tuberculosis is most frequent in childhood in Canton while pulmonary tuberculosis is most frequent in infancy and adulthood. Uttley (1938) showed that tuberculosis caused 14 to 19 percent of the total deaths in Hongkong.

THE ACUTE RESPIRATORY DISEASES

Although reliable statistics are unavilable all evidence indicates that the acute respiratory diseases are a major cause of morbidity and mortality throughout China. As in the case of the acute enteric diseases a large portion of the cases of acute respiratory diseases are attended by the old style native practitioner and are never reported. Malnutrition, improper ventilation and heating, high population densities, and crowded quarters all contribute to a high rate of respiratory disease. Conditions imposed by military operations will aggrevate the already grave situation.

Although epidemics occur in all parts of China, influenza is more frequent in northern China and Manchuria than elsewhere. From 1927 through 1934 the Chinese Eastern Railway Zone reported from 7,000 to 13,000 cases of influenza annually. As in other countries the disease occasionally involves high morbidity and mortality rates. Stedeford (1919) tells of communities near Wenchow in which ten percent of the inhabitants died from influenza and Wilkinson describes an epidemic in St. Helena in which nearly 25 percent acquired the disease. Gear's hospital surveys show that in 1933 and 1934 as much as 2 percent of the admissions into some hospitals were for influenza. Higher rates were observed in northern China than in central and southern China.

Bronchitis is likewise prevalent in China. Hospital admissions are on the average about twice as great as for influenza although this by no means gives a true indication of the relative frequency of these diseases.

Bronchial spirochaetosis was reported by Faust (1922) to have been observed in Amoy (three cases), Nanking (several cases), Wusih (one case), Paotingfu (two cases), and Wuchang (several cases). It was reported from Canton by Cadbury et al (1925) and Huizenga (1923) stated that the disease occurred in Nanking in every month of the year and recorded his observations on 166 cases. Nauck (1928) described it as endemic in the Yangtze Valley.

Pneumonia is likewise an important disease with a generally higher incidence in northern China than in the southern parts of the country. Practically all hospitals reported cases of pneumonia (all types) in 1933 and 1934, although in general they constituted less than one percent of the admissions (Gear, 1934, 1936).

CHAPTER XII

NOTES ON MISCELLANEOUS ACUTE INFECTIOUS DISEASES

The diseases included in this chapter, although sometimes a cause of appreciable morbidity and mortality, are discussed rather briefly because in general they differ little from the same diseases in other parts of the world and because they will therefore present no unusual problems peculiar to China alone. It must be borne in mind, however, that although they are similar to the same diseases elsewhere, epidemics may be more sweeping because of generally crowded conditions, poorer quarantine, and generally lower standards of hygiene.

Scarlet fever is a common disease in China. It was first recorded in Shanghai in 1873 and since that time has been recorded as sporadic and epidemic in various parts of the country. Gear's (1937) survey of hospitals throughout China reveals that the disease has a general distribution. However there is a distinct increase both in mortality and morbidity rates from south to north with the exception of the mountainous province of Yunnan. The greatest number of cases occurs in the 15-24 year age group. Kuan (1930) regarded scarlet fever as a principal cause of death in fall and winter for a number of years in Harbin. From 1916 to 1920 there were great epidemics in South Manchuria Railway Zone. Li (1940) reported 1,584 known cases in the Peiping First Health District (Population 106,000) with a case fatality of 36 percent. Scarlet fever caused 12 percent of the deaths in 1936 and 1937. Chen (1936) gave a specific death rate of 653 per 100,000 in Tinghsien for 1935, the highest of all the 27 causes listed. In Tsinan it has been reported to be one of the most common acute infectious diseases among children (Scott, Pi, and Lair, 1938). From 1936 to 1937 there was an epidemic of the disease throughout north China, during which thousands of cases and hundreds of deaths in Shantung Province were reported by the daily papers (Fan, 1939).

According to the report of the League of Nations for the years from 1926 to 1938 there were 2,223 cases of scarlet fever in Shanghai. Hsu (1936) reported that the disease is uncommon in Canton and only ten cases of mild form were encountered by him during a period of five years. Nauck (1928) also pointed out that it was rare and mild in the southern provinces.

Dick tests have been given to various groups. Table 26 summarizes the results of some surveys. Generally speaking, immunity increases with age and the country people have a lower positive percentage of Dick reactions than town people. The positive percentage is lower in southern China than it is in the northern part of the country.

TABLE 26

RESULTS OF DICK TESTS MADE IN VARIOUS PARTS OF CHINA

Place	No. Tested	Percentage Positive	Investigators & Date
Harbin	1,275	47.7	Lin and Jettmar, 1925
Peiping	646	46.4	Dzen, 1928
Peiping	4,673	42.2	Wu and Ma, 1938
Tsinan	3,825	20.8	Fan, 1937
Shanghai		50.8	Lai, 1931
Canton	1,437	26.2	Hsu, 1936
Hongkong	921	19.1	Davis et al, 1935

Smallpox, because of limited use of vaccinations, is still an important disease in China. According to Maxwell (1929) it was first introduced into China by the Huns between the years of 256-205 B. C. Inoculation was introduced for treatment between the years of 1023-1063 A. D. and was used extensively until the beginning of the last century. Vaccinations were first performed in 1805 and have become popular although their use has been restricted largely to the principal cities. Twenty of 27 hospitals surveyed by Gear reported treating smallpox cases in 1933; 18 of 25 treated smallpox cases in 1934. In no case was the number more than 0.2 percent of the total admissions. In some cities smallpox is an important cause of mortality. For example in a period of five years (1931-1935) Shanghai reported more than 3,000 smallpox deaths; Hangkow (same period) reported more than 8,000; Nanking more than 2,000; Tientsin 1,800; and Hangchow, 1,020. Tao (1935) stated that of 3,225 persons examined in Wusih 27.7 percent were variolated.

In Wa-in also in Kiangsu the rate was 19.8 percent. Uttley (1938) has shown that the smallpox mortality rate in Hongkong during the last 40 years has fluctuated from 0.01 per thousand per year (1926 and 1931) to 2.27 per thousand per year in 1931. Chen and Li (1934) found that about five percent of the population of Tinghsien had had smallpox at some time in the past.

Diphtheria has a wide but rather uneven distribution in China being more characteristically a disease of the northern provinces. However, the disease is by no means absent in the southern provinces as demonstrated by the fact that from 1926 to 1938 Hongkong reported from 70 to 375 cases annually with 30 to 200 deaths. In the same period the number of reported cases in Shanghai has varied from 372 to 1,692 per year. Pang and Zia (1940) studied 168 strains isolated in Peiping and gave the following incidence of types.

Source of strains	Total Number	Gravis No.	Gravis %	Intermediate No.	Intermediate %	Mitis No.	Mitis %
Active cases	117	12	10.3	16	13.7	89	76.0
Contact or carriers	28	1	3.6	1	3.6	26	92.8
Avirulent	20	4	20.0	4	20.0	12	60.0
Total	165	17	10.3	21	12.9	127	76.8

Measles has an incidence in China similar to other countries. However, it is an appreciable cause of mortality. For example Hangchow reported 1,526 deaths due to measles in five years (1931-1935); for the same period Tientsin reported 211, Peiping 699, Tsingtao 759, Shanghai 3,992, Nanking 2,680, Hankow 1662, and Canton 54. There seems to be a general increase in morbidity and mortality rates from south to north.

Whooping cough apparently occurs in all of the provinces of China. It differs in no way from the same disease in other countries.

Mumps may be regarded as widespread in China recurring epidemically at rather frequent intervals. It differs in no way from the same disease in other parts of the world.

Poliomyelitis has been reported from at least sixteen provinces and can be assumed to occur throughout the country although no large epidemics have been reported. Hospital admissions for poliomyelitis constitute, as a rule, less than 0.1 percent of the total hospital admissions.

Chickenpox occurs throughout China and is described as being of a mild type.

Trachoma is a very prevalent disease in China. Its incidence is estimated to vary from about ten percent in Canton to more than 50 percent in parts of northern China. Leger (1931) reported that 30-50 percent of the hospital cases in Hongkong had trachoma whereas the incidence among the children of Hongkong was placed at 70-90 percent. He cites Ling's estimates placing the incidence at 20-30 percent in south China and 50-60 percent in north China. Chen (1929) estimated that there are always about 120 million cases of trachoma in China and that two million people blind in both eyes are among its victims. More than thirty percent of the admissions to Peiping U. M. C. Hospital were found to have trachoma. Throughout the country it is the cause of from one to ten percent of the hospital admissions.

Cerebrospinal meningitis is widespread in China and from time to time assumes epidemic proportions in the central and southern parts of the country. Table ~~25~~ 27 shows the number of cerebrospinal fever deaths in certain large cities as reported by their municipal governments. Maxwell (1929) stated that this disease appears to be more prevalent in the southern and central parts of the country than in the north. However, the hospital survey made by Gear in 1934 indicates that the disease causes 0.3 percent of hospital cases in the north and 0.2 percent in central and south China. The first reported epidemic in China occurred in 1919 when the disease broke out in the central and southern parts of China. It was followed by another outbreak in the following year in the same area. A third epidemic occurred in 1929. This was the severest epidemic ever to occur in China. It extended over central China along the Yangtze Valley. Cases were reported from Hankow, Nanking, Hangchow, Ningpo, etc. Similar epidemics almost as severe and extensive occurred in Shanghai and the lower Yangtze area and in numerous localities along the tracks of the Shanghai-Nanking and Shanghai-Hangchow-Ningpo Railways in 1930 and 1931.

In Chekiang, cerebrospinal meningitis has been reported since 1928 along the estuary of the Chientang River and Hangchow Bay involving thousands of cases with a high mortality. Stevenson and Tang (1920) believed that the disease had been to a certain extent endemic in Luchowfu, Anhwei Province and assumed epidemic proportions in this area in the winters of 1919 and 1920. The disease in this area usually started in the late winter months and increased until the maximum was reached in February and March. Brown and Broady (1935) reported an epidemic of cerebrospinal meningitis in south Hunan in the spring of 1934. The duration of this epidemic was three months from the middle of March to the middle of June. Forty-three cases were seen by the authors in the city of Hengchow, probably representing one tenth of those in the city. The approach of the epidemic was believed to be from the south perhaps from Kwangtung following the line of auto traffic and railway construction.

In Kwangtung the disease first became epidemic in 1918 in Hongkong. In the spring of 1932 it appeared in Macao in epidemic form for the first time. In Hongkong the disease became prevalent in the fourth week of March and continued to be common until the second week of May. In Canton, according to Health Department statistics, the disease began to increase in the first week of March and continued to be prevalent until the middle of May.

Tang and Yang (1933) studied a number of the menigococcus strains isolated in Shanghai, Hangchow, and Huchow. Thirty-three strains were typed carefully with the sera obtained from the National Institute of Health, Washington, D. C. Considering all the strains together, the distribution of the types is as follows:

Type	Percent
I	51.2
II	3
III	21.2
IV	3
I or III	3
Unclassified	16.6

Epidemic encephalitis has been reported from many parts of China. There is, in general, no information as to the virus types involved in these epidemics. The first report of the disease came from Canton in 1919. Subsequent reports have come from Peiping, Mukden, Kalgan, Hwai-yuan, Tsinan, Shanghai, Wuchang, Changsha, Szechwan, and elsewhere. It has been suggested that the disease was introduced from Europe by Chinese returning from the World War. This suggestion assumes a single etiology for all of the epidemic encephalitis of China which seems somewhat unlikely.

In Changsha, Hunan, the first case was reported in 1921. Thirteen more cases were seen in 1925 and 1926 in the same hospital. All cases were natives of the province (Chien, 1927). In 1936 Su reported two epidemics within ten months in Amoy. The first (five cases, all fatal) occurred in July 1935, and the second (four cases, three fatal) in January and February, 1936. The occurrence of the Japanese B type in China was clearly established in 1936 when Kuttner and ~~Tsun~~ Tung (1936) reported two serologically diagnosed cases in Peiping Union Medical College Hospital. Lowenberg (1937) reported that five cases from Shanghai in 1935 and 1936 reported as encephalitis lethargica, were actually cases of Japanese B encephalitis. In the summer of 1938 ten cases of acute encephalitis were observed in the Pediatric Service of Peiping Union Medical College Hospital within 24 days. The symptoms and course of the disease were similar to those of the Japanese B and St. Louis types. The case fatality rate of this small series of cases was 30 percent. Death occurred within the first ten days of the disease (Chu, Wu and Teng, 1940). In 1939 another series of 16 cases was admitted to the same hospital. Of this series, eight patients were studied experimentally with the protection tests in order to ascertain the etiology. In six patients the sera obtained during convalescence showed definite protection against the Japanese B virus infection in mice indicating that these patients were very probably suffering from the Japanese B encephalitis.

Weil's disease and other leptospiroses occur in China although there is some confusion regarding their incidence, distribution, and etiology. In 1928, Li reported that epidemic jaundice occurred in Kaifeng, Honan in the autumn of 1923 and again from September to November 1924 in Kaifeng, Kweiteh and other places of the province. Although statistics were unavailable he estimated that there must have been more than 10,000 cases in Kaifeng alone. In 1929, Wyatt reported that during a period of two years in Taiyuanfu, Shansi, he had often met cases of jaundice associated with a few days of gastric discomfort. In the year of 1928, about the middle of August a serious illness in villages to the north of Taiyuanfu, known by the Chinese as "huangtan" appeared. Since then attacks of jaundice have become common again here, varying in severity from very mild attacks to some causing death in a few days. According to the author, this disease "differs markedly from seven day fever characterized by toxaemic jaundice reported in the C.M.J. by Balme (May 1898) as having occurred here."

Robinson (1929) reported that in the latter part of 1928 there was an extensive epidemic of jaundice in Lintsing, Shantung, largely among the military population but spreading to the civilian inhabitants in the town and countryside. Cases were first seen in September, 1928; the epidemic continued into the following January. It was estimated that there were several thousand cases. These reports have been regarded by some as referable to Weil's disease.

Maxwell (1929) summarized the situation as follows: "Epidemics (of Weil's disease) have been reported from Peking, Tientsin and Paotingfu in Chili (Hopei), widespread over the province of Shantung and from north Kiangsu....No epidemics have been described from south China....". Nauck (1928) however, stated that the occurrence of Weil's disease in China has not been definitely established.

In 1937 Tang reported three cases of icterohemorrhagic jaundice or Weil's disease from Canton in 1934 and stated that this was the first time the disease was described from Canton as well as in China. The author also referred to a severe epidemic in the same year when more than 100 prisoners succumbed to the disease in a rat-infested gaol in the city. Snapper et al (1940) reported two human cases together with canine and murine leptospirosis from Peiping, and stated that the human cases as well as the canine infection were the first reported in north China. There seems to be little information available on the other types of leptospiroses in China.

Rabies is comparatively common in China, a situation to be expected in view of the large numbers of semi-wild dogs in most of the villages. Cases have been reported from most parts of the country.

Rat-bite fever (Sodoku), caused by Spirillum minus and contracted by the bite of infected rats, is considered to be a rare disease and has received little attention in China. Galt (1925) reported a case from Kiulungkiang, Yunnan but the causative organism was not demonstrated. Curtis (1926) reported a case from Funing, Fukien. The incubation period of this case was exactly two weeks. In the same year Cadbury reported two cases in Canton. In 1928 Liu described a case with an incubation period of 22 days in Anhwei and in 1929, Campbell observed a case in Foochow. Yang (1940) described two cases from Kweiyang, Kweichow. The causative organism Spirillum minus was demonstrated in the smear of the exudate aspirated from the local lesion. According to Yang one case of rat-bite fever was reported in Hongkong in 1928 by Aubrey. From this information it may be well concluded that the disease, although uncommon, is widely distributed in China.

Undulant fever, although uncommon, appears to have a wide distribution in China. Early in 1916, Maxwell reported one case from Fukien Province. In 1925 Liu reported a small epidemic among the Hindus in Honan. According to this author the Hindus probably got their infection from India, where the disease was endemic,or from the imported goats which they possessed. Rohow (1931) reported a case in an American marine in Shanghai and suggested that in all probability the milk was the source of infection. Zia and Wong (1932) reported two cases of undulant fever of natural infection and one of probably laboratory infection in Peiping Union Medical College. In 1936 Wong reported a case in Shanghai. The diagnosis was confirmed by a positive agglutination test of 1:2560. However, the disease was believed to be contracted in Kuling. Li, Lang, and Zia (1938) stated that since 1930, one or more cases have been seen each year in the medical service of P.U.M.C. Hospital. Reports of undulant fever cases have also come from Nanking (Nauck, 1928), Chungking (Gear and Pedersen, 1935), and Mukden (Taylor, 1935)

Tetanus is described in ancient Chinese medical literature and is a disease which is widely distributed over the country. Cases have been recorded from time to time in all the hospitals. A relatively high incidence of this disease has been reported in various large cities by their municipal governments.

TABLE ~~26~~ 27

NUMBER OF DEATHS OF EPIDEMIC CEREBROSPINAL MENINGITIS IN CERTAIN LARGE CITIES IN CHINA.*

	1931	1932	1933	1934	1935	Total
Tientsin	2	5	1	4	28	40
Peiping		52	24	46	31	153
Tsingtao	6	7	-	-	-	13
Shanghai	86	7	44	33	22	192
Nanking	73	13	9	42	56	193
Hangchow	487	47	16	4	1	555
Hankow	47	88	52	43	50	280
Canton	22	116	34	24	45	241

* From the Statistical Abstract of the Republic of China, (1935, 1940).

CHAPTER XIII

SCHISTOSOMIASIS

Schistosomiasis, caused by Schistosoma japonicum, is a disease of man and several other species of mammals. The geographic distribution of Schistosoma japonicum is confined to the Far East. It is known to occur in southern Japan, in the central part of Formosa, on certain islands in the Philippines, Celebes, and in China. Schistosomiasis in China is closely associated with rice culture and is widely distributed in the central and southern parts of the country. Faust who has done much work on this parasite in China estimated that there are about 25,000 square miles of the endemic areas containing both the molluscan intermediate hosts and the infected humans or other animal reservoirs and that 50 to 95 percent of the inhabitants in these endemic areas are infected by this disease with a gross case mortality as high as 20 percent. Robertson (1933) stated that an extremely moderate infective index would be seven percent in the endemic areas. The population of these areas is over a hundred million; therefore, there may be upwards of 7,000,000 infected persons in China.

By far the most severely endemic areas in China are in the valley of the Yangtze River, including the regions between its tributaries and around the adjacent lakes. The practices of the rice cultivation in these regions provide an ideal condition for schistosomiasis. During the wet season the whole area is frequently irrigated while in the dry season it is resolved into lakes, swamps, marshes and alluvial bottom land. The rice fields are irrigated during the growing season by natural or artificial canals, which usually have their source in the backwater of the Yangtze River. During the spring and the early summer, when human feces and feces of domestic animals are used to fertilize the fields, the water for irrigation passing the fields brings to the fields a great number of eggs and miracidia which infect the hundreds of thousands of snails inhabiting the grassy banks of these canals and in turn the cercariae freed from these snails are carried by the water to infect farmers as well as domestic animals working in the fields.

The three large lakes, Tai-hu, Po-yang, and Tung-ting all lying near the south bank of the river are important foci. The northern limit of autochthonous schistosomiasis does not extend beyond 34° north latitude. The disease has been reported as far inland as Ichang in the main valley, but above this region for a distance of about two hundred miles no autochthonous cases have been reported. In the western part of SZECHWAN PROVINCE, in the Min River Valley, there is another endemic focus. There are isolated endemic areas coastally from northern KIANGSU PROVINCE to KWANGTUNG PROVINCE. Human cases have also been reported from the Mekong Valley (Lan-ts'ang-kiang) in YUNNAN PROVINCE as well as in the central part of KWANGSI PROVINCE.

There are three monographic works on human schistosomiasis in China: Faust and Meleney (1924), Chen and Li (1930) and Wu and Hsu (1941). Unfortunately the monograph of Chen and Li was unavailable in the preparation of this report.

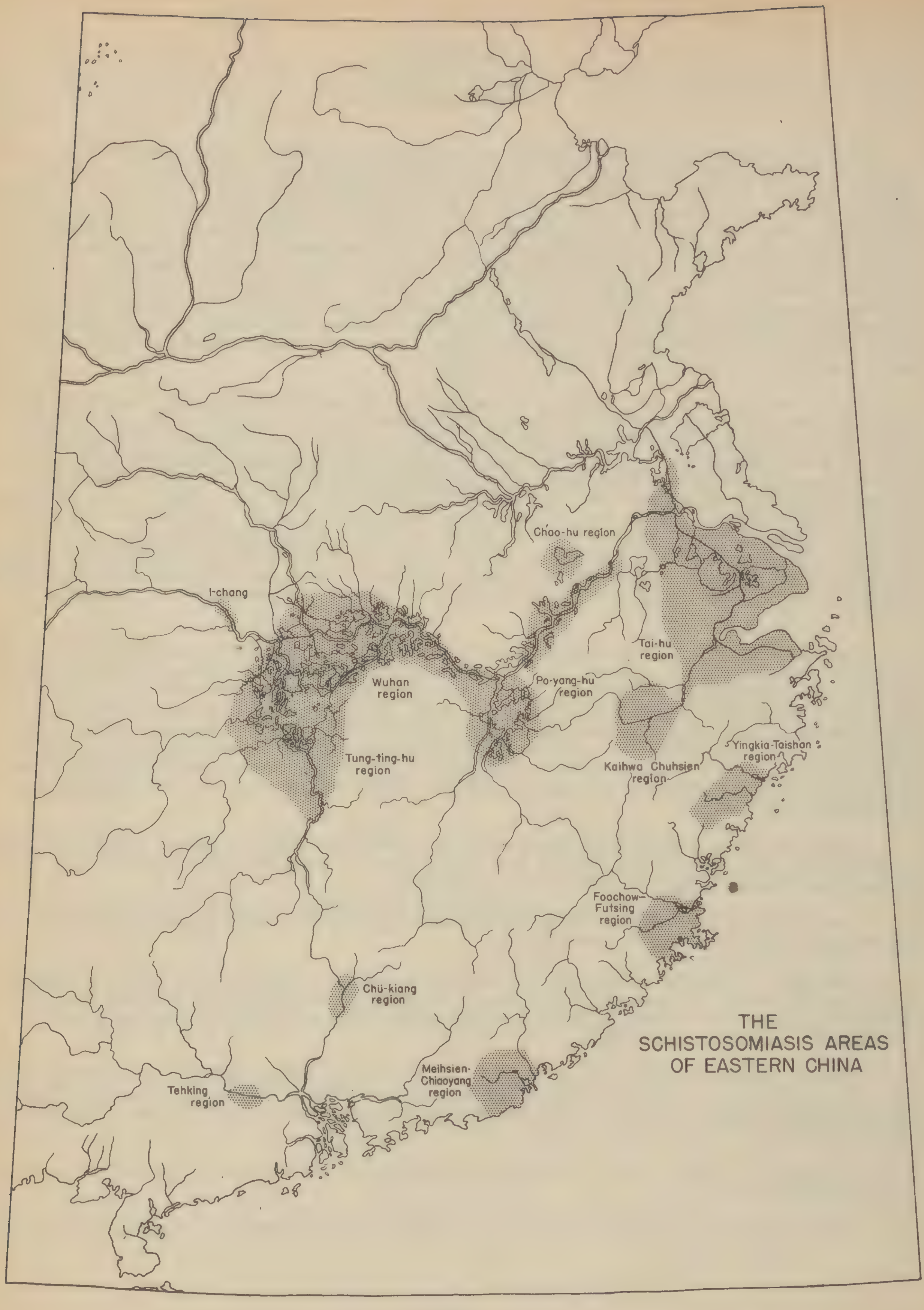
The following is a summary of the distribution of reported human cases. Doubtlessly this list will be expanded by subsequent surveys.

KIANGSU PROVINCE: Shanghai, Pao-shan, Sung-kiang, Tsing-pu, Chin-shan, Wu-kiang, Wu-hsien (Soochow), Ch'ang-shu, Kun-shan, T'ai-tsang, Chia-ting, Wusih, Wu-tsin (Ch'angchow), Kiang-yin, Chin-t'an, Tan-yang, Tan-t'u (Chenkiang), I-hsing, Nanking, Kiang-pu, Kiang-tu (Yangchow), Shao-po- Yen-ch'eng.

CHEKIANG PROVINCE: Chia-hsing, Chia-shan, T'ung-hsiang, Ch'ung-teh, Hai-yen, P'ing-hu, Lin-an, Yu-hang, Hang-hsien (Hangchow) Hai-ning, Wuk'ang, Chu-hsien, Kai-hua, Kiang-shan, Ch'ang-shan, Lung-yu, Chin-hua, Chu-chi, Sheng-hsien, Shao-hsing, Chin-hsien, Ying-chia, Lo-tsing, Tai-shun.

ANHWEI PROVINCE: Wu-hu, Anking, Fan-ch'ang, Wu-wei, Ning-kuo, Hofei, Ch'ao-hsien, Ta-t'ung, Sü-sung.

KIANGSI PROVINCE: Kiu-kiang, Hu-ko, Sha-ho, Teh-an, Yung-hsiu, Nanch'ang, Po-yang.


Ch'ao-hu region
I-chang
Tai-hu
region
Wuhan
region
Po-yang-hu
region
Yingkia-Taishan
region
Tung-ting-hu
region
Kaihwa Chuhsien
region
Foochow-
Futsing
region
Chü-kiang
region
THE
SCHISTOSOMIASIS AREAS
OF EASTERN CHINA
Meihsien-
Chiaoyang
region
Tehking
region

HUPEH PROVINCE: Wu-ch'ang, Hankow, Han-yang, Po-ch'uan, Ts'ai-tien, Han-ch'uan, Hsiao-kan, An-lu, Tsao-shih, T'ien-men, Yueh-k'ou, Mien-yang, Sha-hu, Hsin-ti, Chia-yu Hsien-ning, Chin-k'ou, Pu-ch'i, Huang-peh, Yang-hsien, Huang-kang, Huang-chou, Wu-hsueh, Ta-yeh, Pao-an, Chin-niu, I-ch'ang.

HUNAN PROVINCE: Yueh-yang, Ch'eng-ling-chi, Hua-ying, Ch'ang-teh, Yuan-kiang, I-yang, Hsiang-yen, Ch'ang-sha, Hsiang-tan, Hsiang-hsiang, Hung-yang, Ling-ling.

SZECHWAN PROVINCE: Peng-hsien, Yin-sho, Ying-hsien, Peng-shan, Shuang-liu.

FUKIEN PROVINCE: Foochow, Ma-wei, Ch'ang-lo, Pu-tien, Futsing.

KWANGTUNG PROVINCE: Chu-kiang, Ch'ao-yang, Chieh-yang, Mei-hsien, Teh-king, Fo-shan.

KWANGSI PROVINCE: Pin-yang.

YUNNAN PROVINCE; Burma border, Ta-li, Feng-i.

In considering the incidence of schistosomiasis it should be borne in mind that the information has been obtained by a diversity of examination methods by different investigators and a uniformity of the results cannot be expected. The direct smear method, which was more frequently employed by the earlier workers, does not indicate the true incidence. This was well illustrated by Andrews (1935) who obtained only 39 percent positive by the direct smear method and 67 percent positive by the sedimentation method in a total of 76 positive cases detected by the method of Meleney and Faust. There is no doubt that this disease is more common than is usually suspected and higher incidence will be revealed by improved methods.

In KIANGSU PROVINCE schistosomiasis is far more prevalent south of the Yangtze River than north of the river. Except for a few districts for which there are no positive reports it occurs throughout the area with the focus in the Tai-hu region. North of the river schistosomiasis is endemic only along the banks of the river. However, Wu and Hsu (1941) reported a case who had definitely contracted the disease at Yen-cheng, about 80 miles from the river.

On account of the swift current or tidal ebb and flow the main river banks of the Yangtze are not suitable places for the breeding of the intermediate hosts of japonicum. For this reason the Hwangpu banks are free from schistosomiasis. In a survey of intestinal parasites at the rural area of Kao-chiao, Chu et al (1936) confirmed the absence of japonicum. However, the disease exists in Shanghai city and its vicinity. The earliest record of schistosomiasis in Shanghai dates back to 1910 when the eggs of the parasite were found in the stool of a patient but whether he was infected in Shanghai or elsewhere was not known. Andrews (1935) reported examinations of 1,055 fecal specimens. Three methods of examination were used for the detection of the ova, namely, direct smear, sedimentation and Meleney and Faust's method. Seventy-six cases of schistosomiasis were diagnosed. Of this total the direct smear method gave 39 percent positive; sedimentation method, 67 percent positive, and the method of Meleney and Faust, 100 percent positive. Between December, 1936 and May, 1937, Wu (1938) collected at random small pieces of livers of 399 oxen and 406 buffaloes from several municipal abbatoirs at Shanghai and examined them for the presence of Schistosoma japonicum. He found that the infection rate of the parasite in oxen was 12.6 percent, whereas in the buffaloes it was 18.7 percent. Eggs of japonicum were found in the feces of the infected cattle and adult worms were found in the mesenteric veins of the oxen. The cattle slaughtered in Shanghai generally come from the interior parts of Chekiang Province, and some also from Kiangsu and Anhwei Provinces. All of these places are known to be heavily infected with human schistosomiasis. According to this author there is every reason to assume that there exists no difference between the schistosomiasis of cattle and that of man in China and that cattle probably play an important part in intensifying and spreading the disease in this country. Robertson (1933) reported that toward the end of 1931 a number of foreign visitors to Henli or Tsin-yang-kong who had bathed in the creek were subsequently and simultaneously attacked by symptoms of schistosomiasis. Wu (1938) reported that the Shanghai Hills region, which is situated approximately 20 miles southwest of the city, had been proved to be endemic for schistosomiasis japonica. He found that nearly one percent of 15,223 Oncomelania snails collected in the region had schistosome cercariae.

Human cases of schistosomiasis have been reported from Pao-shan to the north of Shanghai, Tsingpu to the west and Chin-shan to the southwest of the city.

The region surrounding the Great Lake (Tai-hu) is one of the heaviest endemic centers. Soochow, situated on the east shore of the lake has been reported to be infected with this disease. Li (1924) reviewed 1,034 stool-examination records of inpatients of the Soochow Hospital (1921-1924) and discovered 33 (3.1 percent) positive cases of schistosomiasis. According to Robertson (1933) certain villages near Soochow show an incidence of 50 to 97 percent. Meleney and Faust (1923) first reported the discovery of the snail host in this region. They stated that the snail belonged to the genus Hemibia Heude (a synonym of Oncomelania) and was very similar in its habits to Katayama nosophora, the intermediate host of japonicum in Japan.

Yao (1936) when travelling in I-hsing which is situated on the west side of the lake, found human cases and reported that the Oncomelania snails collected there were infected with schistosome cercariae.

Further northeast, on the southern bank of the Yangtze River human cases have been reported in Chenkiang. Chu and Yao (1935) examined 669 soldiers of a communication corps stationed at Chenkiang in 1934 and found 46 (6.87 percent) were infected with Schistosoma japonicum.

Human schistosomiasis has been reported from Yangchow which is situated north of Chenkiang, near the northern bank of the river. Tai (1924) of the Yangchow Baptist Hospital discovered 28 schistosomiasis cases from the routine fecal examinations of 400 inpatients, representing a seven percent infection. According to Chu and Yao (1935), Yao and Lin examined 5,200 individuals in Nanking in 1932 and found 0.31 percent infected with the parasite.

In CHEKIANG PROVINCE the heavy endemic area is in the northeastern part of the province and the region along the Chien-tang-kiang and its tributaries. Light infection is to be found along the coastal region particularly along the valley of Ookiang and the area bordering Fukien Province. In Hangchow Wu (1937) reported that helminthic infection among the people is relatively light. He found Schistosoma japonicum in cats and oxen but added that "eggs of Schistosoma japonicum were rarely seen among the people of Hangchow." He stated that Chen had found only a single case of schistosomiasis among 4,922 middle school students examined at Hangchow between December 10, 1934 and March 26, 1935. However, schistosomiasis constitutes a serious public health problem at Chia-hsing and Chia-shan and neighboring districts. This region is located north of Hangchow and forms one of the heavy endemic centers in this province. From two years continuous observation of one particular area in Chia-hsing district Robertson (1936) found that infection index of the snails was only 15 per thousand in the latter weeks of June and the first half of July. In August and September the actual numbers of Oncomelania hupensis found were greater but the infective index fell to less than two pêr thousand. The author concluded that schistosomiais is not likely to be contracted after the end of September and that mollusks are relatively free from infection until the end of the breeding in the following spring.

Watt (1936) chose Kutang, a small town about three miles west of the West Lake, for the study on the bionomics of the intermediate host of Schistosoma japonicum because it represents " a typical endemic area of schistosomiasis." Approximately 1,000 snails were examined by the author every month for a period of over a year. An average infection rate of 1.28 percent was obtained. There were considerable variations in the infection rate during the course of the year. The highest infection rate, less than 3.5 percent, occurred in the spring and fall just before the snails enter the water and also in the fall after the snails emerged from the water. The lowest infection rates occurred in July and January.

In the west central part of the province, along the upper valley of the Chien-tang-kiang there is located another severely endemic center. This includes Kai-hwa, Chu-hsien, and vicinity. Kan and Yao (1934) reported that from January 23 to April 15, 1933, 544 new cases were admitted to their Clinic in Kaihwa. Of this number 232 were schistosomiasis cases, 42.7 percent of all the new admissions. In an anti-schistosomiasis campaign the authors revealed that the endemic area extends over the whole district of Kaihwa. This is a hilly region on the western border of the province, adjacent to Kiangsi Province to its west. It is composed of the valleys of three streams. Snails numbering 16,942 were collected from 14 different localities and examined for the parasite.

Furcocercariae were found in 442 snails, an average infective rate of 2.6 percent. Cattle and dogs were found to be the reservoir hosts of schistosomiasis in this region.

Kan and Kung (1936) reported that schistosomiasis is very prevalent in Chien-tan-pan, south of Chu-hsien. The infected area includes 77 villages with a total population of 5,609. According to the authors the death rate due to schistosomiasis per 1,000 population among the 28 villages investigated was 11.2 in 1933 and 16.4 in 1934. The following table shows the infection rate of schistosomiasis in Chien-tan-pan area in 1934-1935:

	No. Examined	No. Infected	Percent Infected
Physical Examination	1235	309	18.1
Fecal Examination	592	290	31.4
Physical and Fecal Examination	1234	381	30.9
Reaction to subcutaneous injection	491	378	53.5

A species of Oncomelania was found to be very common in this area. Examination of 16,098 snails revealed that 5.3 percent of them were infected with the parasite.

Schistosomiasis is also endemic in ANHWEI PROVINCE. In Wuhu it has been reported that 8.2 percent of the hospital admissions were cases of schistosomiasis (Houghton 1910). The endemic area extends to Fan-chang and Nan-ling south of Wuhu. Another center of the infection is located in the region of Anking further up along the valley. Human cases of schistosomiasis were reported from Anking as early as 1907 and 1910. Wu and Hsu (1941) reported as many as 50 percent of the inhabitants in this area suffering from ascitic trouble and possibly a large proportion of these are cases of schistosomiasis. A third endemic center has been found in the region around Chao-hu, one of the larger lakes in the province. Liu (1929) reported the first case encountered in the Luchowfu Christian Hospital, in Hofei. Occurrence in Chao-hsien was mentioned by Faust and Meleney (1924). This area is situated about in the center of the province. According to Faust and Meleney (1924) schistosomiasis was also found in Fan-chang, Wu-wei, Ta-tung, and Sin-sung, indicating that the entire river valley is endemic.

Due to the presence of the Po-yang-hu, one of the three largest lakes along the Yangtze Valley, the endemic area in KIANGSI is centered in the northern part of the province.

In HUPEH the entire western part of the province is endemic with the focus of infection in the Wuhan area. The disease is probably not less prevalent in this area than it is in the area around Tai-hu in Kiangsu and Chekiang Provinces. In Wuchang, Faust and Wassell (1921) reported that 3.6 percent of 359 persons examined suffered from schistosomiasis japonica. Routine fecal examinations were made on 632 patients in Hankow by Andrews (1933) and ova of japonicum were found in 32 cases (five percent). Schistosomiasis has been reported as far west as I-chang.

The disease is more widely distributed in HUNAN than it is in Hupeh. The heaviest infection is found in the area around the Lake Tung-ting. According to Robertson (1933) Tootell found that in the Changteh area, which is near the western shore of the lake, 96 percent of the males were infected with this disease and further west in the area of Tu-kow the infection rate among males was about 87 percent.

In SZECHWAN PROVINCE the definitely known endemic area of the disease is the basin region of Chengtu in the valley of the Min-kiang. No cases of schistosomiasis japonica have been reported from the large territory between this basin and I-chang of Hupeh and the actual status of the disease in this region is yet to be investigated.

Schistosomiasis occurs also in the southern provinces although endemicity is less intense than it is in central China. In FUKIEN PROVINCE an endemic focus is found in Futsing district on the coast to the south of Foochow. Tang (1939) reported that physical examinations were made on 1,583 persons from six villages in Futsing and 102 of them showed enlarged spleen and ascites. Fecal samples were collected from these 102 splenomegaly cases and were examined for japonicum with the direct smear method. About twenty (19.6 percent) were found to be positive. It should be borne in mind that this high figure was obtained by direct smear method. As pointed out by Campbell (1940) an even higher positive percentage would have been found if the sedimentation and hatching methods had been used. In 1937, 5.5 percent of 566 patients

admitted to the Harrison Hospital located in the city of Futsing were found to have schistosomiasis. In the Futsing area the intermediate host of japonicum is Katayama tangi Bartsch. According to Tang, who was the first one to discover the snail, the habitat of this snail in Futsing district is similar to those Katayama species elsewhere. It inhabits the grassy banks of secondary mountain streams and the irrigation ditches in porous humans, and wet earth. It is seldom found in water. The irrigation system employed by the rice growers and the practice of using human feces as fertilizer in this region greatly facilitate the spread of the parasite. In a period of one year, Tang (1939) examined 64,460 snails collected in this area. Highest infection was found from September to December (4.8 percent in September).

In the Foochow area the disease was considered to be non-existent or very rare until 1936 when Robertson, Campbell and Kau made their investigations. Robertson (1936) found that the snails, Katayama tangi Bartsch, in Foochow were infected with Schistosoma cercariae. He made extensive stool examinations of one or two of the infected villages near the city and found a large percentage positive and concluded that the disease is present in an intense form in these endemic villages due to repeated infections. Campbell (1936) reported that prior to 1936 the ova of japonicum had never been found in the stools of the patients of the Foochow Christian Union Hospital and that schistosomiasis cases had never been reported from that region. There were records of 200 cases of splenomegaly in the hospital in the majority of which the only diagnosis reached was splenic anemia (Banti's disease). He performed liver biopsy in four cases of the so-called splenic anemia and in two other cases the liver was obtained in autopsy. Ova of japonicum were discovered in three of these six livers. He expressed the belief that most of the so-called Banti's disease of the Orient is actually schistosomiasis. Kau (1936) made histological studies in a series of 13 splenic anemia cases in the same hospital, and demonstrated the presence of the schistosoma ova in the livers of four cases. Campbell (1940) stated that until May 1939, only 21 cases of proved schistosomiasis has been encountered at the Foochow Christian Union Hospital. He believes that schistosomiasis is more common than is usually suspected and the low incidence is due to the inadequate methods of examination. Faust and Kellogg (1929) found an infection rate of 2.17 percent in the mountain villages near Foochow but none in the rice or mulberry villages. Human cases have been reported from the districts of Ma-wei and Chang-lo between Foochow and Futsing and also from Putien to the south of Futsing. Except the region mentioned above and possibly another suspected area near the southern coast bordering Kwangtung the rest of the province is considered to be free of schistosomiasis. Regarding the reservoir host in this province, Faust and Kellogg (1929) first found the eggs of japonicum in buffaloes in Foochow. Positive results were reported by Chen on cattle, dogs, and cats from Futsing (Tang 1939).

In KWANGTUNG PROVINCE an endemic center is found in the valley of the Hankiang in the northeastern corner of the province where cases have been reported from Mei-hsien, Chieh-yang, and Ch'ao-yang. Chu-kiang (Shao-chow) in the North River Valley (Pei-kiang) and Teh-king in the West River Valley (Si-kiang) have also been reported to be endemic. Katayama snails have been found in Fo-shan to the southwest of Canton. From these findings it may be safely assumed that schistosomiasis is widely spread in this province.

In KWANGSI a positive report of the disease has come only from Pin-yang which is located in the south central part of the province in the basin of the West River (Yao, 1938). Yao (Bartsch 1936) reported that the snail host of japonicum in this locality is Oncomelania yaoi Bartsch.

Schistosomiasis has been reported from the western YUNNAN in the Irrawady Valley along the Yunnan-Burma border (Meleney, 1925). Robertson (1940) reported that the Talifu and Feng-i district including Hsiakwan region on the plain in west Yunnan has been found to be endemic. Infected Katayama sp. snails were found in the irrigation ditches during October, 1939. Human cases of the disease were discovered among the local inhabitants proven by positive stool examinations.

Intermediate hosts of S. japonicum. -- Three genera of snails have been determined to serve as the intermediate hosts of Schistosoma japonicum. These are Katayama, Oncomelania, and Schistomophora. Blanfordia has been proved to have no role in the life cycle of Schistosoma although this generic name has been erroneously applied to some species of the other genera (Bartsch, 1936). Hemibia is a synonym of Oncomelania.

As far as is known all the species of Oncomelania are confined in China and this is by far the most important schistosomophorous genus in this country. Katayama is more widely distributed than Oncomelania, ranging from southern Japan through Formosa to Yunnan, China. Schistosomophora has not been found in China.

Bartsch (personal communication) has stated that these snails are very delicate and live only in waters which are slightly acid. This ecologic peculiarity is very important for, by adding lime and neutralizing the water, the habitat becomes unsuitable and the disease is controlled by eliminating the essential intermediate host. Such measures have been practiced in Japan with considerable success.

The following is a list of the species of Katayama and Oncomelania found in China:

1. Katayama fausti Bartsch, 1925
   Syn. Oncomelania nosophora Annandale, 1924 (part)
   K. nosophora Faust, 1924

   Locality: Shaohsing, Chekiang.

2. K. cantoni Bartsch, 1925
   Syn. Oncomelania nosophora Annandale, 1924 (part)

   Localities: Fatshan, rear Canton

3. K. lii Bartsch, 1936

   Localities: Lin-an and Hiau-fen, Chekiang

4. K. tangi Bartsch, 1936

   Locality: Futsing, Fukien

5. Oncomelania moellendorffi (Schmacker & Böttger) 1890

   Localities: Cha-hsien, Chekiang; Pucheng and Nanking, Kiangsu

6. O. longiscata (Heude) 1840

   Locality: Yochow, Hunan

7. O. elongata Bartsch 1936

   Locality: Chekiang

8. O. hupensis Gredler

   Localities: Hankow and Huang-chow, Hupeh; Anhwei

9. O. schmackeri Möllendorff 1880

   Localities: Soochow, Chinkiang, Wukiang, Nanking, Hsin-yang-kang, Sungkiang, and Kiangsu; Kashing, Chekiang.

10. O. multicosta Bartsch 1936

    Locality: Hangchow, Chekiang.

11. O. costulata (Heude) 1890

    Locality: Lake Tung-ting, Hunan

12. O. crassa (Heude) 1890

    Locality: Lake Tung-ting, Hunan

13. O. yaoi Bartsch, 1939

Locality: Pin-yang, Kwangsi

14. O. anhuinensis Li 1936

Locality: Huichow, Anhwei (Li 1936)

According to Wu and Hsu (1941) snails infected with S. japonicum have been collected from the following localities:

Kiangsu Province: Shanghai, Pao-shan, Sung-kiang, Tsing-pu, Chin-shan, Chuan-sha, Feng-hsien, Nan-hwei, Wu-kiang, Wu-hsien (Soochow), Chang-shu, Kun-shan, Tai-tsang, Chia-ting, Wu-hsi, Wu-tsin, Kiang,yin, Chin,tan, Tan-yang, Tan-tu, I-hsing, Kiang-ning (Nanking), Kiang-pu.

Chekiang Province: Chiahsing, Chia-shan, Tung-hsiang, Chung-teh, Hai-yen, Ping-hu, Hiao-feng, An-chi, Lin-an, Yu-hung, Hung-hsien (Hang-chow), Hai-ning, Wu-kang, Teh-tsing, Wu-hsing, Chang-hsing, Chu-hsien, Kai-hua, Lan-chi, Shao-hsing, Feng-hua, Chir-hsien.

Anhwei Province: Snails have been collected from An-King, but there is no record for infected snails.

Kiangsi Province: There is no snail record from this province.

Hupeh Province: Snails have been collected from Hankow, Chin-kow, Yang-hsien but there is no record for infected snails.

Hunan Province: Snails were collected from Yo-yang, Chang-sha, and Lake Tung-ting. There is no record for infected snails.

Szechuan Province: Snails were collected from Peng-hsien. No record for infected snails.

Fukien Province: Futsing

Kwangtung Province: Snails were collected from Canton. No record for infected snails.

Kwangsi Province: Pin-yang.

Yunnan Province: Ta-li, Feng-i

Reservoir hosts. -- As has been stated above dogs, cats, cattle, and buffalo have been demonstrated by various investigators to harbor either adults or ova or both stages of S. japonicm. It is well established that the domestic animals play an important role as reservoirs of human schistosomiasis in China.

CHAPTER XIV

CLONORCHIASIS

Clonorchis sinensis Cobbold, the etiologic trematode of human clonorchiasis, is the most important human liver fluke. It is widely distributed in man and other mammals in Japan, Chosen, eastern and southern China, Formosa, and Indochina. Although clonorchiasis was first observed in a Chinese in Calcutta it was not until 1908 that the disease was recorded in China by Heanley at Canton. The distribution in China is interesting. As summarized by Faust and Khaw (1927) clonorchiasis is common in dogs and cats in the central and lower Yangtze Valley as far north as Peiping. In northern China, where 25 percent of the dogs and 37 percent of the cats are infected, there are no human cases. In central China (Hunan, Hupeh, Anhwei, Kiangsu, and Chekiang) 80 percent of the dogs and practically all cats are infected but there are only infrequent human cases. In southern China, particularly in Kwangtung Province, clonorchiasis is common in man (20-30 percent in many areas) but only 20 percent of the dogs are infected. This seemingly strange distribution is explained by the fact that fish are eaten raw by humans in south China and are rarely fed to dogs and cats whereas in northern China dogs and cats are given raw fish but fish for human consumption are cooked.

Clonorchiasis should not be a hazard to naval personnel in China as long as normal standards of cooking are maintained. As a public health problem it is important primarily in Kwangtung Province.

Geographic notes on clonorchiasis in China. -- Kwangtung Province is the area of heaviest human infection. The highly endemic areas in this province are Chao-chow, Swatow, and Canton. It is closely correlated with the raw-fish eating habits of the natives. Clonorchis infection in this area is limited to the mulberry-fish pond region and to those places supplied with fish from this region. Hainan Island is believed to be free from the infection. In the area around Canton the general infection rate was found to be 20-30 percent while in the mulberry and fish-pond district the infection varied from 44 to 100 percent (Oldt, 1927). Otto (1935) found a rate of 18 percent in Canton whereas Hueck and Wan(1936) reported twelve percent at Tungkun. Faust and Khaw (1927) reported that 3.2-36.4 percent of the population in Canton were infected. Hsü and Chow (1937) showed that at least eleven percent of the population of Canton are infected and Whyte reported a rate of 19 percent at Chao-chow. Greaves (1934-1935) reported an infection of 4.2-4.5 percent in Hongkong. Human consumption of raw fish is prevalent in Kwangtung Province. However, the price is so high as to exclude the poor people from enjoying this delicacy and consequently, the disease is more or less confined to the wealthier inhabitants of the towns. There is a very severe endemic focus in Futsing, Fukien Province.

In central China where fish is not eaten raw the human clonorchiasis is light. However, it is not as rare as was pictured by Faust and Khaw (1927) and Oldt (1927). Komiya, Kawana and Tao (1935) found 4.7 percent of the Chinese and 3.8 percent of the Japanese in Shanghai infected. Chu et al found C. sinensis present only in isolated cases among 1,618 individuals in the rural district of Kao-chiao near Shanghai.

Yao et al (1935) recorded a rate of 0.7 percent in Nanking. In Wuchang, Faust (1925) found 1.8 percent of 57 individuals infected while in Hankow Andrews (1933) reported an eight percent infection based on routine fecal examinations of 632 patients. Occasional cases of human infection with clonorchiasis have also been reported in the provinces of Chekiang, Anhwei, northern Kiangsi, and Hunan (Oldt, 1927, Faust and Khaw, 1927).

In north China the native population is almost free from the infection of clonorchiasis. Faust and Khaw (1927) recorded only a single case in a native who had never been outside of north China. The almost complete absence of human infection in this area is due to the food habits of the people. Fish is eaten cooked and the dogs and cats eat the viscera and scales raw; consequently a high infection rate is observed among these animals.

Reservoirs of clonorchiasis in China. -- Cats and dogs are the most important reservoir hosts for clonorchiasis in China; rats may also play a role. According to Oldt (1927) 25 percent of dogs and 37 percent of cats in north China, 80 percent of the dogs and 100 percent of the cats in central China, and less than 20 percent of these animals in south China have Clonorchis.

In north and central China the people eat cooked fish but dogs and cats eat the viscera and scales raw whereas in south China the price of fish is so high that it is not fed to dogs and cats. Furthermore in north and central China where the flesh is cooked and the cats and the dogs eat the scales, the cysts are found on the under side of the scales. In the south where the fish are eaten raw the cysts are found in flesh. However, Chen* (1934) made a survey of the parasite of dogs from Canton and found that 44.2 percent were infected with C. sinensis. He also studied 57 cats from Canton and 32 from Foochow and found the parasite present in 80 percent of the Cantonese cats and in 59 percent of the Foochow animals. Clonorchis sinensis has been found in rats (Rattus norvegicus and R. rattus) in Canton by the same author (1933). He (1936) gives the first record of hog infection in China from the Cantonese slaughter houses. Kawana (1935) examined 50 cats and 59 dogs in Shanghai for C. sinensis and found the parasite present in 52.0 percent of the former and 13.6 percent of the latter. Kawana (1935) reported that among 243 dogs (mostly field dogs) examined 89 (36.6 percent) were harboring Clonorchis but no infection was found among the house dogs; among 202 cats examined 117 (57.9 percent) were found to harbor the parasites. No Clonorchis infection was found among the 43 rats examined by the author. In north China Oldt (1927) reported that 25 percent of dogs and 37 percent of cats have Clonorchis.

First intermediate hosts of C. sinensis in China. -- Faust (1930) has shown that snails which act as the first intermediate hosts of this fluke are limited to a single subfamily, Bithyniinae Stimpson, represented by four species in China, namely, Parafossarulus striatus Benson), P. sinensis (Neumayr), Bithynia fuchsiana von Möllendorf and B. longicornis Benson. P. striatus is found throughout China, but more commonly in the south; P. sinensis is found in the Yangtze Valley; B. fuchsiana is found throughout the country, but more common in the north, and B. longicornis is distributed from Peiping to Tonkin. Faust and Barlow (1924) found Melania cancellata commonly infected in the vicinity of Shaohsing, Chekiang Province.

Second intermediate hosts of C. sinensis in China. -- Faust and Khaw (1927) found that practically every species of fresh-water fish in China could serve as the second intermediate host of C. sinensis. Over 40 species of fresh-water fishes belonging to the families Cyprinidae, Eleotridae, and Osphronemidae in the Sino-Japanese area have been reported naturally infected with the parasite.

In Canton Hsu and Chow (1937) reported that Clonorchis cysts were found in 14 out of 18 species of fish examined. The five common species of fish in Canton: Ctenopharyngodon idellus, Mylopharyngodon aethiops, Hypophthalmichthys nobilis, H. molitrix and Labeo collaris, were all infected.

In Shanghai, Komiya and Kawana (1936) found that ten out of 15 species of fish ordinarily obtained from market had Clonorchis cysts while Komiya and Tajimi (1940) found eight out of 17 commonly sold species infected. Hsü and Khaw (1936) examined 40 species of fish for Clonorchis in Peiping and found 13 infected. All 13 species belong to the subfamily, Cyprininae.

CHAPTER XV

OTHER TREMATODIASES

Fasciolopsiasis. -- Fasciolopsis buski*, the largest human trematode, is widespread in central and south China. In the south the parasite is encountered in all of the provinces. In the north its distribution reaches beyond the Yangtze River and in the west it has been observed in Chengtu and Suifu of Szechwan Province. The highest incidence of this infection is found in Chekiang Province where the severest endemic center is located in the district of Shaohsing, an area of about 1,600 square miles inhabited by 1,000,000 to 1,500,000 population. In some villages in this area 100 percent infection has been found among the people examined. Barlow (1922) first discovered that "human infection takes place through eating water chestnuts or water red ling grown in infected areas." In the Shaohsing endemic area the molluscan hosts abound in the ponds where these plants are cultivated and the fecal material which is often infected with the parasite eggs is used as fertilizer. This combination facilitates the completion of the life cycle of the fluke and the dissemination of the infection.

Fecal examinations made in Peiping show the incidence of this intestinal fluke to be 0.1-0.5 percent. This does not necessarily indicate that the infection was contracted locally. The incidence along the lower reach of the Yangtze River varies from 0.1 to 2.2 percent according to surveys made in Shanghai, Soochow, Chenkiang, Yangchow, and Nanking. McCoy and Chu (1937) made a survey of 349 primary school children in the city of Shaohsing in the heavily endemic region and reported a 65 percent incidence of infection. Watt (1937) examined 1,120 villagers near Shaohsing and reported that 83.8 percent were infected. Cole (1922) stated that a large number of patients admitted to the wards of C.M.C. Hospital, Ningpo, from Shaohsing, were infected. The infection has also been reported along the Yangtze Valley from Kiukiang (Kiangsi Province), Hankow and Wuchang (Hupeh Province), Changsha and I-yang (Hunan Province), and Chengtu and Suifu (I-pin) (Szechwan Province). Fecal examinations of 632 patients in Hankow revealed a five percent infection with this parasite (Andrews, 1933). Surveys made in Wuchang indicate only about 0.6 percent infection. In the Foochow area Faust and Kellogg (1929) recorded 4 percent infection in one village in the valley among the rice growers but showed negative results among all the other groups examined. According to Maxwell (1929) the disease has also been reported from many places along the coast of Fukien Province. In the province of Kwangtung, Swatow and Canton have been reported to be endemic. Ishii (1929) made fecal examinations of 462 patients in Canton and found the eggs of F. buski present in seven. The same author also reported that four out of six dogs examined in the same area harbored the eggs of the parasite. Otto (1935) reported that 0.6 percent of 797 patients examined in Canton had the parasite. Hunan infection has also been recorded from Hongkong. Chen (1935) stated that Fasciolopsis buski occurred in 24 percent of the dogs of this island.

Other definitive hosts of Fasciolopsis buski. -- Parasitism by this fluke is also common in other animals, especially pigs and cattle. Since Barlow's study it is commonly believed that human infection and pig infection do not exist in the same proportion in the same area. Whereever pig infection is common human infection appears to be rare and vice-versa. Young (1936) made studies of the development of F. buski in seven species of mammals. The animals were examined after being fed with encysted cercariae of the fluke, which were scraped from the skin of the red water caltrop, Trapa natans, collected from the Shaohsing district. He reported that pigs were the most suitable final host for F. buski. Dogs, monkeys, and rabbits can be occasionally infected with the encysted cercariae, but the young worms could not develop, even though they remained in the small intestine for a relatively long period. Cats, sheep, and guinea-pigs could not be infected. According to Craig and Faust (1943) dogs are occasionally infected in Canton, although they appear to be partially resistant to infection.

The intermediate hosts of F. buski. -- The molluscan hosts incriminated in China and Formosa include Planorbis caenosus, Segmentina nitidella, S. calathus, S. schmackeri, S. hemisphaerula (=S. largeillierti), and Hippeutis cantori (Craig and Faust, 1943).

* Brown (1917) claimed that there is more than one species in China under the name of F. buski Cole (1922) pointed out that no difference was observed between the so-called buski, rathonisi, and goddardi from his study of many hundreds of sections. There is now general agreement that one worm is included in this species.

Paragonimiasis. -- Although human paragonimiasis was first described in China by Manson as early as 1880 and a few more cases were subsequently reported from several localities its autochthonous nature in this country was not definitely confirmed until 1930 when Ying reported two cases from the vicinity of Shaohsing which were confirmed later by Maxwell (1931) as autochthonous. Present information shows that this disease is widespread in both man and animals and is endemic particularly in the provinces of Chekiang and Fukien. The reservoir hosts as well as the intermediate hosts of this fluke have been reported from many places in this country.

In southern Manchuria Leo reported the first case from Mukden in 1935. The author claimed that in all probability it was contracted in Mukden. Wang and Hsieh (1937) reported six cases treated in the Peiping Union Medical College Hospital. In central China isolated cases have been reported from Shanghai, Hankow, and western Hunan (Nauck, 1928). Maxwell (1931) mentioned two more cases, one from southern Hunan and another from I-chang, Hupeh. He believed that both of these cases were probably autochthonous. Shaohsing of Chekiang province is an important focus of paragonimiasis. It was from this region Ying (1930) reported his two authentic autochthonous cases. Sputa of 685 persons from 29 villages in the Lantung Valley were examined by Chen and Rose (1935); 134 (19.6 percent) were found to be infected and 187 (27.3 percent) were clinically suspected to have the infection. Vogel, Wu and Watt (1935) studied the life history of the parasite in the same region and reported that Paragonimus was also encountered in Chuchi-hsien further south to Shaohsing. Goodwin (1930) reported a case of paragonimiasis admitted to the C.M.S. Hospital at Ningpo, July, 1929. Wu (1936) reported six more centers of paragonimiasis in addition to Shaohsing and Chuchi; these were Fenghwa, Yuyao, Wuhsing, Kienteh, Kinhwa, and Kaihwa.

The records of paragonimiasis in Fukien Province date back to 1880 when Manson discovered the Paragonimus eggs in the sputum of a native of Foochow in Amoy. Since then a few cases of human infection were reported in Yingtai and Pingnan (Maxwell, 1931). Infected crabs and infected mammals, a tiger and a leopard, were collected from Futsing (Wu, 1936).

Little is known regarding human paragonimiasis in Kwangtung. Chen (1940) reported a case in the Queen Mary Hospital in Hongkong. The patient was a native of Chekiang. He had resided in Hongkong for seven years but made annual visits to his native home.

Knowledge concerning paragonimiasis in the southwestern provinces is extremely limited. All of the fecal examinations made in this region indicate that it appears to be free of the infection. However, in a news letter in the Chinese Medical Journal (1932) it states that, "Dr. James L. Maxwell reports the receipt of information of what appears to be certainly a new center of paragonimus infection in China. Dr. A. J. Watson has written to him mentioning as indigenous a case from Posi a little off the railway south from Yunnanfu City". Chen (1940) stated that recent information from Yunnan and Kweichow indicates that the fluke, probably P. westermani, has been found in these places.

Reservoirs of paragonimiasis in China. -- Chen (1933) found domestic rats, Rattus rattus and Rattus norvegicus, infected with Paragonimus and later (1934) found an infected dog. Wu (1936) in Chekiang found this fluke in two leopards and in ten cats. Chin (1939) reported the parasite from a leopard, a wildcat, a fox, dogs, and pigs in the Changting district, Fukien. Tang (1940) stated that five species of mammals from the Foochow-Futsing region were found to be naturally infected. These included two species of civet cat, the crab-eating mongoose, Rattus norvegicus, and a field mouse. In all of these the mature flukes were found in fibrous capsules in the lung. Chen (1936) reported that Rattus norvegicus has been found to be a natural host in the Canton area and that Rattus rattus is occasionally infected.

The intermediate hosts of P. westermani. -- Vogel, Wu and Watt (1935) reported that three species of Melania were found in the endemic region of Shaohsing. The miracidia penetrated all of them. Altogether 9,754 snails collected from eight infected villages were examined but no cercariae were found. Chen (1935) stated that snails of species Assiminea lutea Adams were found to be highly infected. Wu (1935) found Paragonimus cercariae in Melania libertina. Tang (1940) reported that the first intermediate host of "ringeri type" of Paragonimus in Fukien is Hua foucheana (=Melania toucheana) and that of "rodent type" is Katayama tangi. Chen (1941) collected toucheana from 13 hsien in Fukien but found infected snails only among those from Foochow and Diongloh. As to the second intermediate hosts of the lung fluke, Vogel,

Wu, and Watt (1935) first reported that the encysted metacercariae were found in the crabs, Potamon denticulatus, in the Shaohsing area. He examined 258 crabs from eight infected villages and found the rate of infection varying from 4.6 percent to 27 percent. Wu (1936) collected Potamon crabs from 23 districts in Chekiang and reported that those from the following six districts were infected with cysts of the lung fluke: Fenghwa 33 percent, Yuyao 25 percent Wuhing 8 percent, Kienteh 11 percent, Kinhwa 3.5 percent, and Kaihwa 7.1 percent. The same author also recorded from Futsing, Fukien, crabs of the species Parathelphus (Parathelphus) sinensis infected with the fluke. Chen (1935) reported Sesarma (Holometopus) dehaani and S. (S.) intermedia as the crab hosts of Paragonimus in Canton. Tang (1940) stated that the second intermediate host of the "ringeri type" in the Foochow-Futsing area is the crab Potamon (P.) denticulatus, while that of the "rodent type" belongs to the species Parathelphusa (P.) sinensis. According to Chen (1940) Paragonimus iloktsuenensis has been found in certain crabs in Fukien.

Other intestinal Trematodes reported in China. -- The liver fluke, Fasciola hepatica, is considered to be cosompolitan and parasitizes practically all herbivorous and many omnivorous mammals. In China fecal examinations by Lin (1924) indicate a 0.03 percent infection rate among the students examined in Peiping. Maxwell (1921) observed one human case in south Fukien. Chen (1935, 1936) reported one percent of infection among the hogs in Canton while 18 percent infection was reported among the buffaloes and 10 percent among hogs in Hongkong. Metagonimus yokogawai-infection has been found in ~~Peiping~~ Linchiang (Lin and Wu, 1927) and among the Japanese people living in Shanghai (Komiya et al 1936). Heterophyes-infection has also been reported from Shanghai (Andrews, 1938). Hsü (1940) recovered two specimens of Echinostoma jassyense Leon and Ciurea in the small intestine of a Chinese male, who had died of chronic myelogenous leukemia in the Peiping Union Medical College Hospital. This represents the second report of this parasite since its discovery by Léon in 1916. See Appendix I for the data of other parasitic trematodes as determined by fecal examinations.

CHAPTER XVI

THE CESTODIASES

The tapeworm infection was known in China in ancient times. Modern studies of this disease began in 1910 when the Research Committee of the China Missionary Medical Association reported that a medical officer in Tsingtao saw 13 cases of Taenia solium and 28 cases of T. saginata among European residents (1899 and 1907). The same report contains records of tapeworm infection from other parts of the country, one case from each of the provinces of Hopei, Hunan and Chekiang; three cases from Peiping; and three cases from Hankow. In Manchuria, the taeniasis is reported as uncommon. Clark (1912) reported a case of T. solium in the province of Yunnan and remarked that taeniasis was common in that province. In 1923 Mills reported that T. saginata had been discovered or suspected in 12 cases during two years among about 4,500 hospital patients in Peiping Union Medical College Hospital. All of these cases contracted their infection in Peiping. He pointed out the erroneous assumption that the beef obtainable in Peiping is not infected with tapeworm and suspected that the incidence of infection among the native population is probably higher than the records would indicate. Native treatment and indifference to the infestation tend to decrease the number of cases seen. The author stated that he had secured numerous samples of beef containing Cysticercus bovis. Hu, Khaw and Frazier (1930) reported that in the Peiping Union Medical College Hospital during a period of ten years, 143 cases of intestinal taeniasis were observed, of which 49 were differentiated on the bases of examination of tapeworm proglottids. Of these 49 cases, 44 were due to Taenia saginata and five to Taenia solium. The authors stated that saginata is also more frequently encountered than solium in other parts of the country. Wu (1939) reported on stool examinations of 56,286 patients in the same hospital. The total positive cases of taeniasis was 337 (0.6 percent). Among the 337 positive cases, a diagnosis of the Taenia species has not been made in 153 cases. Among the remaining cases 156 cases were found to be saginata and 28 solium. In Tsinan, Shantung, Liang (1932) reported only a single case with solium in the Cheeloo University Hospital since 1914.

In central and south China the information regarding taeniasis is meager. It has been shown by various investigators that Taenia infection occurs not only in north China but also in central and south China (Wu, 1939). Faust (1923) stated that an endemic center of Taenia solium is known to exist in northern Hupeh around Siang-yang, and somatic taeniasis was once diagnosed from Soochow. Maxwell (1921) reported one case of saginata from southern Fukien. Ishii and Tei (1931) found the eggs of saginata in persons and on vegetables examined at Amoy.

Reported human infections with cesticercosis cellulosae in China are rare. Altogether only about 40 cases are to be found in literature. The first case was reported by Barnes(1922). The patient was a native of Weihaiwei and developed generalized cysticercosis after his return from India. Faust (1923) stated in reference to somatic taeniasis that it was diagnosed once from Soochow. Mills (1924) mentioned one case from Manchuria seen in the Peiping Union Medical College Hospital. Hu, Khaw and Frazier (1930) reported six cases seen in the P.U.M.C. Hospital during a period of ten years. Chin (1933) reported 13 cases of cysticercus cellulosae in the Pathology Laboratory of the Peiping Union Medical College among 26,300 surgical specimens examined. Feng (1934) added eight more cases, all conjunctival. Chung and Lee (1935) reported ten cases among the residents of north China.

Hydatid disease, caused by Echinococcus granulosus, was not considered endemic in China until 1930 when Loucks reviewed the disease in the country. The author reported 11 cases for which operations had been performed at the Peiping Union Medical College Hospital, together with five other cases in which the clinical diagnoses had been made but not confirmed by operation or autopsy. At the same time he assembled the records of 20 additional cases previously reported from China. In 1934 the same author recorded two more cases observed in Peiping. He concluded that the parasite certainly exists in Hopei and in Kansu, and probably throughout the whole of the

wool-producing area of northern and western China. Ideal conditions for the dissemination of the parasite exist in these regions, due to the presence of large herds of sheep, large numbers of dogs and poor standards of hygiene and sanitation.

Sparganosis caused by the larvae of Diphyllobothrium mansoni was first recorded in Amoy by Manson, who in 1882 removed several milky-white ligulate worms from the kidney fat of an autopsy subject. These worms were forwarded to Cobbold who named them Ligula mansoni. No further case of human sparganosis was reported in China until 1927 when Campbell (1928) described such worms which he had removed from an ulcerated thumb of a patient from a village near Pagoda Anchorage, Foochow, In this case there was reported a history of applying split frog meat to the abscessed wound. In 1936, Campbell, Webster, and Li reported five cases of human sparganum infection in the Foochow area two of which were orbital sparganosis. According to the local people the infection is rather common in this district. The first intermediate host is a Cyclops; the usual second intermediate hosts, frogs and snakes, acquire their infection by ingesting the infected first hosts; and the usual definitive hosts, dogs and cats, become infected from eating raw frog and snake meat containing the sparganum larvae. Faust, Campbell and Kellogg (1929) stated that throughout the Far East spargana have been found abundantly in the tissues of various species of frogs, snakes, birds and mammals. In fact, in central and south China it is exceptional to find frogs and snakes not parasitized with these worms. The same statement holds true for the hedgehog, Erinaceus dealbatus, in the region of Peiping. Siao (1934) collected 553 frogs, probably Rana nigromaculata and R. tigerina, from the market in Shanghai and found 83 (15 percent), of them with mansoni. The infected part was chiefly in the thigh and the majority of the frogs were infected with one worm each. The author stated that the ordinary ways of preparing the frogs for food give no chance of infection to man with this larval worm. Chen (1936) found a single worm in a hog in Canton.

Other species of Diphyllobothrium. -- The adults of Diphyllobothrium latum have been found in man at Pinchiang (central Manchuria) among 1.4 percent of 220 individuals examined (Lin and Wu, 1927) and also in Peiping in about 0.04 percent of 2,641 students examined (Lin, 1924). Faust, Campbell and Kellogg (1929) gave the following species as occurring in China: D. decipiens common throughout East Asia from India to Japan, although it appears to have a more northerly distribution than D. mansoni; D. ranarum common throughout China, Indo-China, and Burma; D. erinacei known in its adult stage only from experimental material from the vicinity of Peiping; D. houghtoni known from man from the Yangtze Valley, although adult specimens have also been found in cats in Peiping.

Human infection with Hymenolepis nana seems common and widespread in China. The first record of this infection was reported by Faust (1923) in Cheefoo in 1918. Wang (1938) reviewed 171 cases of the infection detected in the routine fecal examination of 51,856 patients* (1926 to 1937). Infection rates (6.6-7.0 percent) have been reported by Faust (1924) among the patients in Peiping and Wuchang (repeated examinations).

Other tapeworms occurring in man in China are H. diminuta and Dipylidium caninum (Faust, 1926); neither are of importance.

* In Peiping.

CHAPTER XVII

THE INTESTINAL NEMATODIASES

Ascariasis. -- Ascariasis is prevalent throughout China although the incidence is higher in the south than in the north. No helminth survey fails to reveal the presence of this parasite and in several occasions the infection rate is over 90 percent. It is believed that about one-half to three-fourths of the general population harbor this parasite. The infection is generally contracted from vegetables which are contaminated by soil polluted by human feces.

Cort and Stoll (1931) first made an extensive survey of the ascariasis among five groups from widely separated rural areas. One group lived in villages near Chefoo in northern Shantung Province, one just north of Yangtze River near Nantungchow, two in the Yangtze Delta near Soochow and one in the Canton Delta. The incidence of ascariasis in the group near Nantungchow was also very high in both children and adults, being 82-94 percent in males and 91-96 percent in females. Near Soochow 54-78 percent of the males and 65-80 percent of the females among the group in rice cultivation were infected with Ascaris while 34-65 percent of the males and 38-58 percent of the females among the group in mulberry cultivation had the infection. Among the group near Canton Delta ascariasis was found to be 46-85 percent in males and 63-85 percent in females. They found that the people in the Canton Delta were the most severely infected of any group in the world which had been examined by egg-counting technics. Winfield (1937) reported that in the summer of 1934, 1190 rural people from 13 villages near Tsinan of Shantung Province were examined by the Stoll egg-counting technic and 81 percent were found positive.

Winfield and Chin (1938) made egg-count examinations of 2,751 city residents in and around Tsinan and showed that 35.4 percent had ascariasis.

In western China, Chang and Lin (1940) examined fecal samples from 1,578 hospital patients, 1,011 school children, 241 soldiers and 66 "old people" in Chengtu and vicinity. The ascariasis rate was found to range from 36.8 percent to 82.5 percent according to different groups.

The incidence of ascariasis is generally higher among children than it is among adults. Table 26 shows the incidence among Chinese school children reported by various investigators at different localities.

In addition to the high incidence and widespread infection the number of worms and eggs harbored per person is also found to be very high in China. Maxwell (1929) stated that it is quite common to find a hundred or more worms in the intestine. He quoted one case where a boy of twelve passed 5,000 worms in less than three years. Hsü et al (1940) reported that in one case, a Chinese woman of 29 years of age, 1,978 worms were discovered during autopsy and in another case, a Chinese male of 23, as many as 320 worms were evacuated at one time, both representing the heaviest infection by Ascaris lumbricoides ever recorded in literature.

The survey made by Cort and Stoll (1931) indicates an average of 22,000 eggs per gram after corrected to a standard population. The examinations made by Winfield (1937) among the country residents of west Shantung show an average egg count of 14,000 per cc. while those made by Winfield and Chin (1938) among the city residents in Tsinan show an average egg count of 3,800 per cc. Chu et al (1936) reported an average egg count of 21,891 per cc. among the rural people of Kao-chiao, Shanghai. It is interesting to quote the statement by Winfield (1937) regarding the economic loss due to Ascaris in this country: "If it is considered that 80 percent or 340,000,000 of China's 400,000,000 people are rural then on the basis of these egg counts 251,000,000 of China's peasants harbor ascaris and the whole 340,000,000 average about 16 worms per person or there are 5,440,000,000 adult ascaris parasitic in the country people of China. On the basis of the 2,483 examinations of city people made by the author and his colleagues in Tsinan, 21,000,000 of the 60,000,000 urban people of China are positive for ascaris with an average of about four worms for each of the entire 60,000,000 or there are another 240,000,000 adult ascaris that parasitize the city dwellers. We, therefore, arrive at an estimate that there are 335,600,000 people in China that are parasitized by a total of 6,080,000,000 adult ascarids. This high population of ascarids is maintained because this number of worms is capable of producing 608,000,000,000,000 eggs per day or 220,000,000,000,000,000 eggs per year. This

mass of adult worms would weigh about 48,640,000 catties or 24,300 metric tons, which is equivalent to the weight of about 442,000 men. If it is assumed that it costs as much to nourish a catty of worm tissue as it does to nourish a catty of human tissue and that a man can be fed for $4.00 per month or $48.00 per year (this is about the cost of food eaten by country people in north China) then it costs $21,000,000 Chinese currency annually just to feed China's ascarids."

Toxocara canis Werner, 1782. -- This is a cosmopolitan parasite of dogs. It has been reported once from a man in Egypt. In China, Lin (1924) reported five cases among 2,641 students examined in Peiping. Chang and Lin (1940) found one case among 1,011 school children in Chengtu.

Ankylostomiasis. -- The investigation by Cort, Grant, and Stoll of the China Hookworm Commission (1926) laid the basis for understanding the importance of the hookworm disease in this country. These workers concluded that while hookworm was found in almost all parts of China it could not be considered to be of any public health importance in north China nor was it important in all parts of central and south China. Hookworm disease was shown to be an occupational disease, confined in a severe form to farmers engaged in silk culture and truck gardening. In areas where these occupations are common, hookworm disease is of considerable public health significance. Such areas were shown to be present in east central China, Kwangtung and Hainan. In many of these places the morbidity is as high as 100 percent. The rice cultivation in the region bears no significance regarding the dissemination of the disease.

In north China, where the sanitary conditions seem very favorable for the spread of the infection the disease is kept to a very low level by the adverse climatic conditions and the difference in agricultural methods. In this region there is a comparatively low rainfall with cold winters. The dry method of using human feces as fertilizer is employed in contrast with the wet method of the other areas. No evidence has been obtained indicating ankylostomiasis in this part of the country as a public health problem. The dry northwest provinces of KANSU, SHENSI, NINGHSIA, and TSINGHAI are relatively free from this disease.

In central and south China, ankylostomiasis has a wide distribution. In the Yangtze Delta, including southern KIANGSU PROVINCE and northern CHEKIANG PROVINCE, it is regarded as one of the most important medical problems. The infection here is spread, principally through the cultivation of mulberry trees. Heavy endemic centers are found in the Soochow area and intense infection has also been reported from Anhwei Province. In the HUNAN-HUPEH area there are places where hookworm infection is considered to be one of the major diseases. In this area the dissemination of the infection is through the vegetable cultivation. The recent reports of Williams (1940) and Chang and Lin (1940) indicate a high incidence of hookworm infection in Chengtu and its vicinity in western SZECHWAN PROVINCE. Chang, Tong, Li and Chin (1942) reported that severe ankylostomiasis was found over a large section in north Szechwan and in certain areas in the eastern and southern parts of the province. In the rural area near Langchung in northern Szechwan 90.0 percent of 574 individuals examined were positive for the infection. The average egg count was 3,313 per cc. of feces. In Tzelintsing of the southern part of the province the incidence was found to be 77.4 percent. It is interesting to note that no association between mulberry cultivation and hookworm disease exists in the sericulture areas of this province and that on the other hand a high correlation between corn-sweet potato cultivation and hookworm disease previously unrecognized in China was reported. In Foochow (FUKIEN PROVINCE) the incidence is fairly heavy in the mountain regions as shown in the survey made by Faust and Kellogg (1929). The most important and widespread endemic areas of the disease are to be found in KWANGTUNG PROVINCE. Here again the major factor facilitating the spread of the disease seems to be the cultivation of mulberry trees although the raising of vegetables is also considered as a factor in some places. On HAINAN ISLAND hookworm is a problem of major significance. Bercovitz (1924) reported that fully 80 percent of the people on the island are more or less heavily infected with hookworm. According to the author in the Kachek region the infection runs from 80 percent in Vin Sio district to 90 percent in the Vang Tsin district and about 100 percent among the aboriginal Miao and Boi tribes of the mountains.

In KWANGSI PROVINCE, a high incidence of ankylostomiasis has been reported from the Wuchow district on the border of Kwangtung.

Due to the fact that in most of the investigations for the intestinal helminths in China the

species of hookworm discovered is not specified, the relative proportion of Ancylostoma duodenale and Necator americanus remains more or less obscure. However, it is believed that the prevalent species is Ancylostoma duodenale, although Necator americanus is also often found. It would appear that about 80 percent of the hookworm infections are due to the former species, and the remaining 20 percent due to the latter (Maxwell, 1929). In Peiping, Lin (1924) found that 1.7 percent of 2,641 students examined harbored Ancylostoma duodenale while 0.27 percent of them harbored Necator americanus. Hsü and Chow (1938) found the former species from 14.4 percent of 809 autopsies performed whereas the latter species was discovered only from 2.8 percent of the autopsies. Faust and Kellogg (1929) showed that in the Foochow area the hookworm carriers in the Chinese villages harbored Necator while those among the Hak ka mountaineers had a pure infection of Ancylostoma duodenale. Necator infection is probably considerably higher in the south than it is in the north as N. americanus is better adjusted to warmer climates than is A. duodenale. On Hainan Island, where hookworm infection is most prevalent, 25 specimens of N. americanus were collected from the intestine of a pangolin (Manis pusilla) by Wu and Hu (1938).

Ancylostoma malayanum (Alessandrini, 1905) an ursine species which has been reported from man, has been found from the small intestines of Ursus torquatus in Opien, Szechwan (Hsü and Hoeppli, 1938).

Trichuriasis. -- Trichuriasis or whipworm infection is almost as ubiquitous as ascariasis in China, although the infection is not as heavy. Maxwell (1929) estimated that about 40 percent of the population when taken over a large area are infected with this parasite. The incidence varies considerably in different parts of the country. In many places its prevalence is lower only than ascariasis and hookworm while in other places it even exceeds both of them.

The studies of Cort and Stoll (1931) on five groups of rural people from widely separated regions indicate that the incidence of this parasite is very high (over 80 percent) in most of the groups. Among the group near Chefoo on the northern coast of SHANTUNG PROVINCE the incidence of trichuriasis is uniformly high (73-92 percent). In the rural population near Nantungchow of the north bank of the Yangtze River in KIANGSU PROVINCE the incidence was found to be 79-82 percent in males and 72-93 percent in females. Both of the groups near Soochow show a comparatively low Trichuris infection. The incidence among the rice cultivation group was 26-44 percent in males and 26-67 percent in females while that among the mulberry cultivation group was 20-42 percent in males and 0-38 percent in females. Chu et al (1936) gave a trichuriasis incidence of 42.5 percent among 1,618 rural people examined from Kao-chiao, Shanghai as compared to 76.4 percent for ascariasis, and 7.8 percent for hookworm. The surveys made by Komiya et al (1939) among different groups of the Japanese people in Shanghai show an invariably higher infection with whipworm than that with Ascaris or hookworm. In the Foochow area the trichuriasis incidence is higher than ankylostomiasis in both the rice villages and mulberry villages although the opposite is true in the mountain villages (Faust and Kellogg, 1929). In Canton, 5.3 percent of 797 patients harbor this parasite (Otto, 1935). High trichuriasis incidence was also found in the highland provinces of KWEICHOW and YUNNAN (Lin and Yao, 1936). In the northwestern provinces of SHANSI, SHENSI, KANSU, and TSINGHAI whipworm infection is comparatively light (Curran and Feng, 1930; Taylor, 1931; and Hsu, 1943).

Enterobiasis. -- The pinworm, Enterobius vermicularis, is also a common parasite in China. However, its frequency is very much lower than the other common intestinal nematodes; about 50 percent of the investigations made in China revealed the presence of this worm. The highest incidence (13.5 percent) was obtained by Hsü and Chow (1938) among 809 autopsies in Peiping. The northwestern provinces seem to be free from the infection. An infection of 0.2 percent has been reported in west central Shansi (Curran and Feng 1930), 0.3 percent in Shanghai (Andrews, 1938) and Nanking (Yao et al, 1935), 1.5 percent among the mountain village (Hak Ka Tribe) in the Foochow area (Faust and Kellogg, 1929), 0.2 percent among 632 patients around Chengtu (Williams, 1938; Chang and Liu, 1940), and 0.2 percent among one group of school children in Kwe-yang.

Strongyloidiasis. -- From the available information it appears that the strongyloidiasis infection is less common than pinworm. Houghton (1910) reported four cases at Wuhu General Hospital in 1909 and Maxwell (1921) saw six cases at Yung-chun in southern Fukien. A comparatively small percentage of the fecal examinations reveal the presence of this parasite. Faust (1929) found 0.04 percent of 13,617 patients in Peiping (examined three times each) positive. In the Wuhan area, 0.4 percent positive was reported at Hankow (Andrews, 1933) and 5.3 percent

at Wuchang (Faust, 1924). In Chengtu in western Szechwan Strongyloides infection was reported in only one of six groups of people examined, the incidence being 0.06 percent (Chang and Lin, 1940). The parasite seems most prevalent in Fukien in the Foochow Area. Faust and Kellogg (1929) reported that 2-10 percent in the mulberry villages, and 5.8-12 percent in the mountain villages were infected with the worm. In the northwest 1.1 percent of 92 patients at Langchow (Taylor, 1931) and in the southwest 0.81 percent of 823 children in Kweiyang (Lin and Yao, 1936) were found to be infected.

Trichostrongylus orientalis Jimbo. -- Positive records for this infection are rare. Lin and Wu (1927) reported 0.8 percent of 350 examined at Pinchiang in north Manchuria infected with this worm. In Peiping 0.03 percent of 13,617 patients examined three times each (Faust, 1924) and 0.1 percent of 2,641 students (Lin, 1924) were found to be positive. Andrews (1933) reported an infection 0.4 percent among 632 patients in Hankow. In Shanghai a comparatively high incidence (0.7-3.4 percent) was reported among the Japanese students (Komiya, Kawana and Tao, 1936).

Trichinosis. -- Little is known regarding human infection by Trichinella in China. Koo (1941) examined diaphragm samples from 320 hogs and 48 rats, in Fukien Province. Five (1.6 percent) of the hogs and four (11 percent) of R. norvegicus were found to be positive. Infections were light in hogs but heavy in rats. The parasite has also been found in pork in Amoy, and in dogs, cats and hogs in Manchuria. Riley and Chen (1932) reported the negative results of examination for this infection among the pigs and rats in Canton.

TABLE ~~26~~ 28

INCIDENCE OF ASCARIASIS AMONG CHINESE SCHOOL CHILDREN

Locality	No. Examined	Incidence %	Investigator and Date
Tsinan (urban, Shantung)	895	43.90	Winfield & Chin, 1938
Lungshan (rural, Shantung)	124	89.00	Winfield, 1937
Shanghai	1,412	35.90	Yu, et al, 1934
Shanghai	55	20.00	Komiya et al, 1936
Kao-chiao, (rural, Shanghai)	1,618	76.40	Chu et al, 1936
Nanking	2,877	34.58	Yao et al, 1934
Chengtu	1,011	82.49	Chang & Lin, 1940
Kweiyang	823	91.86	Lin & Yao, 1936
Southern Yunnan	355	84.79	Lin & Yao, 1936

CHAPTER XVIII

VENEREAL DISEASES

The venereal diseases constitute one of the most important groups of infectious diseases in China. The hospital surveys made by Gear (1934, 1936) show that 6.2 percent of the hospital admissions were primarily for venereal diseases in 1933 and 5.9 percent in 1934. Wu (1927) stated that general statements of medical practitioners concerning the frequency of venereal diseases indicate that these diseases are rampant everywhere, often to an alarming extent. In some localities as much as 50-60 percent of the adult population has been reported to be infected. Lennox (1919) reported that among 4,000 married men of poor and middle class 22.2 percent admitted having had gonorrhea, 6.9 percent syphilis, and 3.9 percent having had both.

The five plague prevention hospitals in north Manchuria record an average of 6.4 percent syphilis admissions while in Newchwang 13.5 percent syphilis and 14.8 percent gonorrhea are reported. In Shanghai, the Shantung Road Hospital records an average of 6.6 percent of all admissions between 1870 and 1925 as being cases of venereal diseases. In Hongkong the incidence of syphilis in hospital admissions varies from 1.5 to 3.2 percent while the incidence of gonorrhea, is recorded as 2.5 percent (Wu, 1927). Maxwell (1929) pointed out that syphilis in the past has been pre-eminently a disease of the large cities, in some of which it has been very prevalent, whereas in the country the incidence has been generally low. However, he emphasizes that this statement refers to the past rather than to the present as there are reasons to believe that the distribution of syphilis is being steadily equalized throughout the country because of the ravages of the armies during the civil wars.

Gear's surveys do not reveal any geographic differences of significance in venereal diseases between the hospitals of north China and those of the Yangtze region or south China although a slightly higher incidence of the diseases was obtained from the hospitals of the Yangtze region for both years. As to the relative incidence of syphilis and gonorrhea in hospital admissions Gear's survey of 1933 indicates only a slightly higher incidence of the former (syphilis 3.3 percent, gonorrhea 2.6 percent).

Routine Wassermann reactions as given in Soochow, Peiping, and Shanghai among various population groups show an average of 17.3 percent positive.

Yaws is not a disease of China. Imported cases are frequently observed but only a few autochthonous cases have been recorded. The disease apparently has been unable to establish itself in China. Maxwell (1929), however, has suggested that gangosa, frequently regarded as a manifestation of yaws, occurs in China.

CHAPTER XIX

SKIN DISEASES

Due to generally unsanitary conditions especially among the poorer classes skin diseases as a whole are prevalent in China. But because of the lack of statistical data it is not possible to indicate their relative prevalence in any degree of accuracy. However, it is unlikely that they will cause many unusual problems among naval personnel. The following notes contain some general information on the distribution and prevalence of some of the contagious skin diseases known to occur in China.

Dermatomycoses of various kinds are common and widespread. Mu and Kurotchkin (1939) made a statistical study of dermatomycoses observed in Peiping from 1925 to 1938. A total of 36,847 dermatologic cases were seen in the Peiping Union Medical College Hospital during this period. Clinical diagnoses of fungous diseases of the hair or skin were made in 6,013 cases (16.3 percent). Spores or mycelia were found in 2,531 of these. The data were classified as follows:

Type of Infection	Clinically Diagnosed		Microscopically Diagnosed	
	No.	Percent	No.	Percent
Favus of scalp	110	1.83	92	3.67
Tinea of scalp	1,493	24.83	1,104	43.61
Tinea of body	1,273	21.17	760	30.02
Tinea of hands and feet	3,024	50.29	526	20.77
Tinea of nails	113	1.88	49	1.93
Total	6,013	100.00	2,531	100.00

The fungus responsible for the cases of favus of scalp was stated to be Achorion schoenleinii. The fungi occuring in tinea of the scalp were reported to be Trichophyton violaceum, T. endoectothrix, Microsporon ferrugineum, and T. glabrum. The most important etiologic agent of tinea of the body was Epidermophyton rubrum, which was also very commonly isolated from tinea of the hands, feet and nails. Frazier (1926) reported that ten percent of the 925 students in the Western Hills Orphanage west of Peiping were found to have ringworm of the scalp. Hu, Kurotchkin and Frazier (1932) reported that 119 of 300 factory workers in Peiping were treated for tinea capitis. Jouveau-Dubreuil (1919) stated that tokelau (tinea imbricata) is not rare in Szechwan. It also occurs in Honan and Shantung although this disease is most common in the humid warm region of southern coastal provinces.

Hongkong foot is found in all parts of China. It is common in Peiping during the summer months and occurs with equal frequency among Chinese and foreigners. It is believed that the common type of straw slipper used in China is often the source of the disease.

Doubtful cases of Madura foot have been reported from Wuchow in Kwangsi Province and Hoihow on Hainan Island but the actual status of this disease in China is not clear (Maxwell, 1929). According to Maxwell (1929) actinomycosis is fairly common in China. It is most common in the jaw, but infections of lungs, abdomen, and extremities have also been observed. Scabies is excessively prevalent, especially among the poorer classes. Tropical ulcer has been reported from Chungking, Szechwan (Maxwell, 1929). Pediculosis is common.

Leprosy has been known in China from times immemorial. It is a wide-spread disease occurring in most, if not all, of the provinces. It is estimated that one-third of the leper population of the world is located in China. But the relative frequency in different parts of the country varies considerably. Manson for the Amoy region estimated it at one in 450 of the general population. Wong placed the number of lepers in Kwangtung at 10,000 but Maxwell considered this too low. Hueck (1935) stated that a conservative estimate of the number of lepers in Kwangtung is 200,000. Shantung is estimated to have one leper per 1,000 population while in Yunnan it is estimated that the lepers form one percent of the total population. According to Maxwell (1929) the incidence in Yunnan is much lower. In general it seems to be less common in the north than it is in the south. Wu (1933) has grouped the provinces according to the incidence of leprosy:

1. Kwangtung and Fukien
2. Yunnan, Kwangsi, Kweichow
3. Anhwei, Hupeh, Kiangsi
4. Kiangsu, Chekiang
5. Shantung, Szechwan
6. Shensi, Shansi, Kansu
7. Manchuria

He stated that the remaining provinces are more or less free of the disease. However, in Gear's hospital surveys of 1933 and 1934, cases of leprosy were also reported from the provinces of Hopei, Hunan and Honan.

Taylor (1931) showed that the hospital cases of leprosy in Mukden Hospital from 1923 to 1931 vary from 0.12 to 0.69 percent of the total admissions. Gear's data indicate that leprosy is highly endemic in Shantung Province. The province of Kwangtung is known to be the worst in China. Scott (1931) estimated that there were 30,000 lepers in Swatow district alone.

CHAPTER XX

ANIMALS OF MEDICAL IMPORTANCE

The animals included in this chapter are those which are of importance as essential intermediate hosts, reservoirs, vectors, ectoparasites, or pests. Strictly endoparasitic species are not included.

Culicidae (Mosquitoes)

The role of mosquitoes in the tramsmission of malaria, filariasis, dengue, and possibly encephalitis is discussed in Chapters I, II, and VII. The mosquitoes of China are discussed systematically in Appendices B and C.

Tabanidae (Horse Flies)

Tabanid flies are numerous in China, both in actual numbers, and in numbers of species. Although at least two species of *Chrysops* are known to be intermediate hosts of *Loa loa* in Africa, there is no evidence of disease transmission by the Chinese species. Appendix D contains a list of Chinese Tabanidae as compiled by Wu (1940).

Flebotomus

Flebotomus is the only genus of medical importance in the family Psychodidae (sand flies). The role of this genus in the transmission of kala-azar is described in Chapter V; a list of the species known to occur in China is given in Appendix E.

Heleidae (Biting Midges)

Wu's catalogue (1940) of the insects of China contains only one species in this family, *Ceratolophus trichopus*, which apparently does not attack man. Doubtlessly this family is much better represented in China than is indicated by this single record.

Simuliidae (Black Flies)

A single species, *Simulium equinum*, has been recorded from China according to Wu (1940). In view of the fact that seven species of simuliid flies are known to occur on Formosa it is highly probable that the Chinese fauna is much more extensive.

Muscoid Flies

Wu's catalogue (1940) lists nearly five hundred species of muscoid flies known to occur in China. The majority of these are of no known medical importance.

Flies which frequent human habitations or which feed on or alight on human food may be important mechanical vectors of disease such as dysentery, if their food habits or breeding media also include human excrement. Several groups of such flies are represented in the coastal provinces of China by members abundant enough to be of medical importance. Among the Sarcophagidae, *Sarcophaga melanura*, *Sarcophaga albiceps*, *Sarcophaga striata*, (=*S. haematodes*), *Sarcophaga peregrina* (=*S. fuscicauda*), *Sarcophaga securifera*, and *Sarcophaga haemorrhoidalis*, are important in this respect. Among the Calliphoridae, *Aldrichina grahami* (=*Calliphora grahami*), *Phaenicia sericata* (=*Lucilia sericata*), *Lucilia caesar*, and *Chrysomya megacephala*, are important, the last species being a latrine fly in many parts of its range. In parts of China, *Phaenicia sericata* often produces traumatic myiasis.

The house flies, *Musca*, and the lesser house fly, *Fannia canicularis*, have the additional dangerous habit of regurgitating ingested food on substances upon which they are resting; this adds greatly to the possibility of contaminating food. The common species of this group represented in this region are *Musca domestica*, the doubtfully distinct *Musca vicina*, *Musca sorbens*, and *Fannia canicularis*. A related species, *Musca* (*Philaematomyia*) *crassirostris*, sucks blood obtained from wounds or by rasping away scabs, while *Stomoxys calcitrans* is a primary blood sucker, members of both sexes feeding in this way.

Cimicidae (Bed Bugs)

Bed bugs are found throughout China and are more prevalent in public places such as hotels and dormitories than in private houses. Both the common bed bug, *Cimex lectularius*, and the tropical bed bug, *C. hemipterus*, occur. The former has a wide distribution whereas the latter is found principally in southern parts of the country. *Cimex hemipterus flavifusca* Wendt was described from as far north as Hsuchow of northern Kiangsu Province. There is experimental evidence to show that bed bugs are capable of transmitting a number of diseases, but there is no satisfactory evidence that they are the vectors under natural conditions.

Anopleura (Lice)

The body louse, *Pediculus humanus corporis*, occurs throughout China although it is more common in the north and in the higher altitudes in the south. The head louse, *Pediculus humanus capitis*, is widespread as also probably is *Phthirius pubis* although precise information is lacking. The role of the body louse in the transmission of typhus fever and relapsing fever is discussed in Chapters III and IV.

Siphonaptera (Fleas)

Fleas are important in the transmission of murine typhus and plague (Chapters IV and VI). Appendix F contains a list of fleas known to occur in China. For identification it is recommended that Liu's monograph (1939) be procured.

Ixodoidea (Ticks)

At present there is no information indicating that ticks are of medical importance in China. However, *Ixodes persulcatus* has been reported from the Amur River region and Japan. Russian investigators have shown it to be the vector of the tick-borne encephalitis which is endemic in some of the Asiatic republics of the USSR. This disease is believed to be transported by infected birds and mammals and it is possible that it eventually may be encountered in China. Appendix G contains a list of ticks of China. The tick fauna of China is actually poorly known; many additional species will doubtlessly be found.

Leeches

In the tropical parts of the southern provinces blood-sucking leeches may be troublesome. *Haemadipsa zeylanica* is probably an important species in this respect although doubtlessly others are involved. Chin (1941) has reported cases of leech infestation in Kweichow Province.

Mollusca and Crustacea of Medical Importance

Various species of snails are important as essential intermediate hosts of Trematoda. Completion of the life cycles of these parasites is impossible without the presence of the proper species of snails. The various species involved are discussed in conjunction with the various species of trematodes. In general taxonomy of snails is difficult; all identifications made in the field should be checked and verified by a gastroped specialist.

When it is desired to have identification made or confirmed by a gastroped expert, the material should be sent to the U. S. Naval Medical Center, Bethesda, Maryland, Attention: Curator of Mollusks, U. S. National Museum. Material for such identification should be preserved in 70 percent alcohol. The amount of alcohol should be ten times the bulk of the specimens. Locality data and collecting dates are essential. Notes on possible roles as intermediate hosts are desirable.

Certain species of fresh-water crustacea are important as second intermediate hosts of human helminths. These are discussed in conjunction with the helminth species involved.

Fish of Medical Importance

Certain species of fresh-water fish, primarily of the families Cyprinidae, Gobiidae, Anabantidae, and Salmonidae, are the second intermediate hosts in the life cycles of *Metagonimus yokogawai* and *Clonorchis sinensis.* However, the species of fish involved cannot in most cases

be discussed with any degree of completeness. Because of this and the highly technical nature of the identification of fish it is suggested that the services of an expert be obtained in identifying suspected species. Caution must always be exercised to insure the thorough cooking of all fresh-water fish used as food.

Poisonous and venemous fish are not of particular importance in China although some cases of fish poisoning have been recorded. The species involved are the same or similar to those involved in other areas of the Pacific.

Poisonous Snakes

Poisonous snakes have been a hazard in south China for centuries. In an essay, "On the Snake Catcher", Liu Tseng-yuan of Tang Dynasty described the fierce poisonous snakes from Yungchow (Hunan) and stated that the snakes were causing so much damage that the government allowed the people to pay their taxes by catching snakes. Pope (1935) lists 130 species and subspecies of Chinese snakes belonging to nine families and 46 genera. With the exception of seasnakes (Hydrophiidae) there are only three families which include poisonous snakes. These are the Elapidae, Viperidae, and Crotalidae. Altogether 19 species and subspecies of these families have been recorded from China (Appendix H). There are no statistics regarding snake-bite poisoning caused by these species.

Mammals of Medical Importance

Several rats of the genus *Rattus* occur in China. Among them are *flavipectus* (south China), *tistae* (south China), *caraco* (north China); *norvegicus* (north China), and *rattus*. The role of these rats as reservoirs of plague and typhus is discussed in the respective chapters dealing with these diseases. In northern and northwestern China various species of wild rodents, particularly marmots, are involved as reservoirs of plague. Certain mammals are of importance in China in that they are also definitive hosts of human trematodes and therefore constitute reservoirs of the trematodiases. These are discussed in the sections dealing with the trematodiases. Dogs are now thought to be reservoirs of kala-azar (Chapter V); rabid dogs are relatively common.

BIBLIOGRAPHY

Anderson, H. G., 1934. A test survey of intra-thoracic tuberculosis in the Shanghai region. Chinese Med. J. 48(3): 207-220.

Ando, K., Kurachi, K. and Nishimura, H., 1931. A new endemic plague area in the northeastern part of inner Mongolia. Kitasato Arch. Exp. Med. 8(1): 25-38.

Andrews, M. N., 1933. The incidence of intestinal parasites in the Wuhan area. Chinese Med. J. 47(4): 390-396.

_____, 1933. Leishmania in the organs of a Shanghai dog. Trans. Roy. Soc. Trop. Med. Hyg. 27(1): 1.

_____, 1935. A case of canine kala-azar occurring in China. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 1: 679-681.

_____, 1935. The examination of faeces for the ova of Schistosoma japonicum. Chinese Med. J. 49(1): 42-46.

_____, 1938. A survey of intestinal parasites in Chinese hospital patients in Shanghai. Chinese Med. J. 54(4): 341-350.

_____, and Chu, T. C., 1937. Note on a malaria survey in Kiao-Chiao. Chinese Med. J. 52: 884-886.

Annandale, N., 1924. The molluscan hosts of the human blood fluke in China and Japan, and species liable to be confused with them. Am. J. Hyg. Monogr. Ser. No. 3, 1924 app.

Baisas, F. E. and Hu, S. M. K., 1936. Anopheles hyrcanus var. sinensis of the Philippines and certain parts of China, with some comments on Anopheles hyrcanus var. nigerrimus of the Philippines. Monthly Bull. Bureau Health Manila 16(6): 205-242.

Bare, N. H., 1930. Notes on diseases of the Sino-Tibetan border. China Med. J. 44(12): 1157-1167.

Barlow, C. H., 1922. Life cycle of Fasciolopsis buski: Discovery of means of infestation of human beings. China Med. J. 36(6): 546.

_____, 1923. Life cycle of Fasciolopsis buski (human) in China. China Med. J. 37(6): 453-472.

_____, 1925. The life cycle of the human intestinal fluke Fasciolopsis buski (Lankester). Am. J. Hyg. Monogr. Ser. No. 4, 98 pp.

Barnes, J. E., 1922. Chinese patient with Cysticercus cellulosae. China Med. J. 36(6): 546

Bartsch, P., 1936. Molluscan intermediate hosts of the Asiatic blood fluke, Schistosoma japonicum, and species confused with them. Smithsonian Misc. Coll. 95(5): 1-60.

_____, 1936. A new intermediate host of the Asiatic blood fluke, Schistosoma japonicum. Proc. Biol. Soc. Washington 49: 139-142.

_____, 1939. A new intermediate host of the Asiatic blood fluke, Schistosoma japonicum Katsurata. J. Washington Acad. Sci. 29(4): 173-175; also Chinese Med. J. 56: 171-172.

Bassett-Smith, P., 1923. Dengue or seven-day fever. J. Roy. Naval Med. Serv. 9(4): 285.

Bennett, C., 1931. Hospital and College reports. General Hospital, Shanghai, 1930. China Med. J. 45(7): 686.

Bercovitz, N., 1923. The hookworm problem in China. China Med. J. 37(7): 576-581.

_____, 1924. Hookworm control in Hainan, a study of 2507 cases treated in campaign in Kachek region. China Med. J. 38(5): 413-417.

_____, 1926. The 1926 Hoihow cholera epidemic. China Med. J. 40(12): 1237-1240.

_____, 1935. Tropical diseases in relation to general health in Hainan, China. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 2: 849-852.

Billinghurst, W. B., 1922. Amoebic dysentery. China Med. J. 36(4): 287-297.

Boeckh, R., 1925. Beitrag zur Epidemiologie und Klinik der Malaria tropica. Arch. Schiffs- u. Trop. Hyg. 29(7): 305-316.

Braafladt, L. H., 1920. Asiatic cholera: A study of one hundred cases. China Med. J. 34(3): 243-251.

Brown, C. F. and Broady, R. A., 1935. Cerebro-spinal meningitis. Report of an epidemic in south Hunan. Chinese Med. J. 49(2): 155-159.

Brown, N. W., 1917. The Fasciolopsinae of China. A study of two species from Chekiang Province. Bull. Johns Hopkins Hosp. 28: 320-329.

Brown, R. E., 1923. Campaign against smallpox in Wuhu. China Med. J. 37(3-4): 239-245.

Buddle, R., 1928. Entomological notes on the Canton delta. J. Roy. Naval Med. Serv. 14(3): 190-200.

Burkwall, H. F., 1937. Diseases encountered among the Loi aboriginals in the Five Finger Mountains of Hainan. Chinese Med. J. 51: 93-96.

_____, 1943. Blackwater fever, a statistical report of twenty-five cases seen on Hainan Island. Am. J. Trop. Med. 23(2): 285-292.

Cadbury, W. W., 1920. The 1918 pandemic of influenza in Canton. China Med. J. 34(1): 1-17

_____, 1920. Lethargic encephalitis in Canton. China Med. J. 34: 371-373.

_____, 1926. Rat-bite fever in China. China Med. J. 40(12): 1204-1207.

_____, 1929. Some recent advances in medicine. Lingnan Sci. J. 8: 443-448.

_____, 1934. An epidemic of cerebrospinal meningitis in Canton in 1932. Chinese Med. J. 48(6): 536-550.

_____, 1935. Seasonal incidence of malaria on Honam Island, Canton. Lingnan Sci. J. 14(2): 241-248.

_____, 1938. Malarial parasites and distribution of malaria on Honam Island, Canton, China. Lingnan Sci. J. 17: 623-638.

_____, Jen, L. N. and Harvey, J. L., 1925. Bronchial spirochetosis in Canton. China Med. J. 39(5): 408-412.

Campbell, H. E., 1928. Report of the second case of sparganosis from man in China. J. Parasit. 14: 196.

Campbell, H. E., 1929. Rat bite fever. China Med. J. 43(9): 931-933.

_____, 1936. Splenomegaly in the Foochow area, with special reference to schistosomiasis, and its relationship to cryptogenetic splenomegaly (Banti's disease). A preliminary report. Chinese Med. J. 50(11): 1561-1576.

_____, 1938. Schistosomiasis and Banti's disease. An inquiry into their possible relationship. Chinese Med. J. 53: 459-466.

_____, 1940. Schistosomiasis in Fukien. Chinese Med. J. 58: 126-127.

_____, Webster, J. L. A. and Li, S. Y., 1936. Human sparganosis in the Foochow area. Chinese Med. J. Suppl. 1: 423-433.

Canright, C. and Anderson, H. G., 1931. A preliminary note on leprosy in Szechwan. China Med. J. 45(9): 880-882.

Chand, N., 1919. Public health of Tengyueh, Yunnan, 1917-1918. China Med. J. 33(1): 76-80.

Chang, H. C., Chen, K. C. and Chou, S. K., 1936. Further observations on the diagnosis of amoebic dysentery. Chinese Med. J. 50(1): 17-26.

Chang, K., 1935. A general survey of the protozoa parasitic in the digestive tract of Shangtung mammals. Peking Nat. Hist. Bull. 9(3): 151-159.

_____, 1939. Notes on intestinal protozoa of butchers. Peking Nat. Hist. Bull. 13(4): 261-263.

_____, and Ch'in, H. T., 1943. An evaluation of pickled vegetables in the dissemination of Ascaris lumbricoides. Chinese Med. J. 61A(2): 63-69.

_____, and Lin, C. C., 1940. Intestinal parasite infections of man in Chengtu and its vicinity. Chinese Med. J. 58: 570-581.

_____, Tong, W. K., Chin, H. T. and Li, C. H., 1943. Quantitative studies on Ascaris lumbricoides in Szechwan. Chinese Med. J. 61A(4): 166-169.

_____, _____, Li, C. H. and Chin H. T., 1942. The epidemiology and importance of hookworm disease in Szechwan Province. Chinese Med. J. 61A(1): 1-8.

Chang, M. L. Y., 1934. Herpetological notes of Kiangsi. Peking Nat. Hist. Bull. 9(2): 141-146.

Chang, S. L., 1938. Relapsing fever in Changsha. A report of 41 cases. Chinese Med. J. 54(2): 163-172.

Chang, T. L., 1939. Mosquitoes of Hunan Province, with special reference to Anopheles. Chinese Med. J. 56: 52-62.

_____, 1940. The anopheline mosquitoes of Yunnan. Notes on their breeding habits and adult behavior. Chinese Med. J. 58: 218-233.

_____, 1941. Malaria transmission in western Yunnan. The natural vectors. Chinese Med. J. 59: 54-66.

Chang, Y. H., Li, C. C. and Young, M. P., 1935. A clinical and laboratory study of 196 cases of malaria. Chinese Med. J. 49(5): 477-478.

Chao, H. A., 1927. Diagnosis of dysenteries. Differentiation of bacillary and amoebic dysentery by cyto-diagnosis. Review of 321 cases of dysentery. Nat. Med. J. China 13(4): 324-331.

Ch'en, C. C., 1933. Scientific medicine as applied in Ting Hsien. Third annual report of the rural public health experiment in China. Milbank Mem. Fund Quart. Bull. 11(2): 97-129.

_____, 1936. The development of systematic training in rural public health work in China. Milbank Mem. Fund Quart. Bull. 14(4): 370-387.

_____, and Li, F. J., 1934. Controlling smallpox under Chinese rural conditions. Chinese Med. J. 48(2): 153-157.

_____, Yü, H. W. and Li, F. J., 1937. Seven years of jennerian vaccination in Tinghsien. Chinese Med. J. 51(6): 953-962.

Chen, C. T., 1943. Ascaris in liver and bile ducts. Chinese Med. J. 61A(2): 51-53.

Chen, F. K., Kurotchkin, T. J. and Hu, C. K., 1931. Tinea favosa in Peiping. Nat. Med. J. China 17(4): 529-533.

Chen, F. T., 1926. A general discussion of schistosomiasis. Nat. Med. J. China 12(3): 243-250; (4): 353-362; (5): 482-490.

Chen, H. T., 1933. A preliminary report on a survey of animal parasites of Canton, China, rats. Lingnan Sci. J. 12(1): 65-74.

_____, 1934. Helminths of dogs in Canton, with a list of those occurring in China. Lingnan Sci. J. 13: 75-87.

_____, 1934. Notes on Paragonimus in rats. Lingnan Sci. J. 13: 329-330.

_____, 1935. A preliminary note on the life history of Paragonimus in China. Lingnan Sci. J. 14: 143-144.

_____, 1935. On a distome metacercaria from a rat. Lingnan Sci. J. 14: 157-158.

_____, 1935. The intermediate host of Paragonimus. Lingnan Sci. J. 14: 695.

_____, 1935. Animal parasites of hogs, goats and buffaloes from Hong Kong. Hong Kong Naturalist 6(2): 102-104.

_____, 1936. Parasites in slaughter houses in Canton. Part 1. Helminths of Kwangtung hogs. Lingnan Sci. J. 15: 31-44.

_____, 1936. Further notes on the life history of Paragonimus from rats. Chinese Med. J. Suppl. 1: 368-378.

_____, 1939. Quelques observations sur un cycle évolutif de Paragonimus dans le sud de la Chine. Annales Parasit. 17(2): 155-161.

_____, 1940. Morphological and developmental studies of Paragonimus iloktsuenensis with some remarks on other species of the genus (Trematoda: Troglotrematidae). Lingnan Sci. J. 19(4): 429-530.

Chen, K. C., 1941. Paragonimus in Fukien. Nat. Med. J. China 27(9): 550-552.

Chen, P., 1925. Fecal examination of Kwangtung students in Peking for Clonorchis sinensis. Nat. Med. J. China 11(1): 41-45.

Chen, W. L., 1934. Preliminary report on an epidemiological survey of paragonimiasis in Shaohsing region. Quart. J. Prov. Hosp. Hangchow 2-3: 69-73.

_____, and Rose, G., 1935. Untersuchungen über die Verbreitung der menchlichen Paragonimiasis im Talbezirk von Landin (Provinz Chekiang, Hsien Shaoshing). Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 1: 519-524.

Chen-Wong, Z. C., 1941. Blackwater fever in Kunming. Report of three cases. Chinese Med. J. 59(4): 387-388.

Cheng, K. C. and Khoo, F. Y., 1935. A case of acute intussusception complicating typhoid fever. Caduceus 14(1): 86-88.

Cheng, M. Y., 1944. An investigation of infant mortality and its cause in Chengtu. Chinese Med. J.(Washington) 62(1): 47-54.

Ch'eng, Y. L. and K'ang, H. J., 1936. Cysticercosis cellulosae in man. (Report of a case with very severe infestation, especially of the brain.) Chinese Med. J. 50(2):137-139

Chi, C. K., 1939. Perforation of gallbladder in typhoid. Report of a case. Chinese Med. J. 56:287-289.

Chi, N. W., 1936. Report of the 1935 plague expedition Lungyen. Rep. Nat. Quarantine Serv. Shanghai Ser. 6, 1935-36: 135-138.

Chiang, H. T., 1924. Splenomegaly with ascities. Nat. Med. J. China 10(6): 387-390.

Chiang, S. F., 1926. The transmission of human Entameba histolytica in rats. Nat. Med. J. China 12(5): 447-452. (In Chinese).

Chiang, W. L. and Yang, C. S., 1933. Prevalence of malaria in the Mausolean district in Nanking. Chinese Med. J. 47(7): 689-693.

Chien, M. H., 1927. Encephalitis epidemica. Nat. Med. J. China 13(4): 332-338.

Ch'in, K. Y., 1933. Nodules or tumors in subcutaneous and other tissues due to Cysticercus cellulosae. Chinese Med. J. 47(11): 1181-1190.

_____, and Hu, C. H., 1940. Pathological lesions caused by B. dysenteriae. A study of 89 autopsied cases. Chinese Med. J. Suppl. 3: 120-144.

Chin, T. G., 1939. Notes on the definitive and intermediate hosts of Paragonimus from Changting, Fukien. Lingnan Sci. J. 18(4): 525-528.

Chin, T. H., 1939. On helminth parasites of rats in Kweiyang. Chinese Med. J. 56: 548-558.

_____, 1941. Note on leech infection in man. Chinese Med. J. 60: 241-243.

_____, and Li, K. C., 1942. A survey of the metazoan parasites of the domestic cat, Felis domestica, of Kweiyang. Chinese Med. J. 61A(1): 30-36.

Chin, Y. T., 1936. On some mosquitoes collected from Manchuria. Peking Nat. Hist. Bull. 11(1): 23-25.

Chiu, P. P., 1939. The occurrence of blackwater fever in the new territories of the Kowloon Peninsula (Hong Kong). Report of a case. Chinese Med. J. 56: 157-158.

Ch'iu, P. T. Y., Ho, E. A. and Li, C. C., 1940. The incidence of tuberculous infection and pulmonary tuberculosis among 8,282 Chinese, with special reference to students in Peiping. Chinese Med. J. 58: 556-569.

Chou, C. H., 1930. Trachoma in north China. A statistical study of 1393 cases. Nat. Med. J. China 16(5): 585-594.

Chow, C. Y., 1940. The common blue-bottle fly, Chrysomyia megacephala, as a carrier of pathogenic bacteria in Peiping, China. Chinese Med. J. 57: 145-153.

Choy, P. D. and Ludlow, A. I., 1926. Ova of Paragonimus westermanii encysted in the abdomenal wall. China Med. J. 40(4): 326-328.

_____, _____, 1931. Paragonimus westermanii encysted in the sac of inguinal hernia. China Med. J. 45(6): 556-559.

Christophers, S. R., 1926. A. (Myzomyia) pattoni, a new Anopheles from Shan-Tung, north China; with notes on some other species of Anopheles from the same locality. Indian J. Med. Res. 13(4): 871-877.

_____, 1933. The Fauna of British India including Ceylon and Burma. Diptera, 4, Family Culicidae, Tribe Anophelini. Taylor and Francis, London. xi & 371 pp.

Chtcherbakoff, S. G., 1930. Les maladies tropicales à Kachgar (Chine ouest). Rev. de Méd. et d'Hyg. Trop. 22: 233-256

Chu, C. F., 1937. Schistosomiasis japonica in Nanking. Chinese Med. J. 52: 651-664.

Chu, F. T'., Deitrick, S. and Chung, S. F., 1931. Relapsing fever in children. A study of twenty-six epidemic cases. Nat. Med. J. China 17(2): 224-232.

_____, and Tso, E., 1930. Typhoid fever and the paratyphoid fevers in infancy and childhood. A study of sixty-five cases. Nat. Med. J. China 16(5): 572-584.

_____, Wu, J. P. and Teng, C. H., 1940. Acute encephalitis in children, a clinical and serological study of ten epidemic cases. Chinese Med. J. 58: 68-78.

Chu, H. J., 1940. Studies on Clonorchis sinensis in vitro. Part 3. Survival period in relation to certain dyes. Chinese Med. J. Suppl. 3: 255-259.

_____, and Hsü, C. L., 1940. Studies on Clonorchis sinensis in vitro. Part 4. Combined effect of certain violet and X-rays. Chinese Med. J. Suppl. 3: 260-266.

_____, and Lai, D. G., 1935. Distribution of modern-trained physicians in China. Chinese Med. J. 49(6): 542-552.

Chu, S. Y., 1936. Tientsin Quarantine Station. Annual report for 1935. Rep. Nat. Quarantine Serv. Shanghai Ser. 6, 1935-36: 135.

Chu, T. C., Liu, B. C., Ling, C. Y. and Zee, G. F., 1936. A survey of intestinal parasites in the rural experimental health area at Kao-Chiao, Shanghai. Chinese Med. J. 50(9): 1243-1254.
*
Chun, J. W. H., 1923. Pneumonic plague in Harbin (Manchurian epidemic 1921). China Med. J. 37(1): 7-17.

_____, 1928. On the comparative frequency of non-pulmonary tuberculosis in north China. Nat. Med. J. China 14(4): 245-251.

_____, 1930. The new plague menace in Manchuria. Nat. Med. J. China 16(1): 111-113.

_____, 1930. On the causes of epidemics. Nat. Med. J. China 16(4): 395-401.

* Chu and Yao, 1935. See p. 149: Report on the investigation of schistosomiasis in Chekiang.....

Chun, J. W. H., 1935. An analysis of the cholera problem in China with special reference to Shanghai. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking,(1934) 1: 399-409.

_____, 1936. Some meteorological factors in smallpox and cholera. Rep. Nat. Quarantine Serv. Shanghai Ser. 6, 1935-36: 42-56.

Chung, H. L., 1936. Studies on the transmission of relapsing fever in north China. Preliminary observations. Chinese Med. J. 50(11): 1723-1734.

_____, 1938. Filtrability of the Chinese strain of Spirochaeta recurrentis. Proc. Soc. Exp. Biol. Med. 38(1): 23-26.

_____, 1938. The cerebrospinal fluid of patients suffering from the Chinese strain of relapsing fever. Trans. Roy. Soc. Trop. Med. Hyg. 31(6): 625-634.

_____, 1940. On the relationship between canine and human kala-azar in Peiping and the identity of Leishmania canis and Leishmania donovani. Chinese Med. J. 57: 501-522.

_____, and Chang, F. C., 1939. Relapsing fever. Clinical and statistical study of 337 cases. Chinese Med. J. 55(1): 6-33.

_____, and Chang, J. H. M., 1938. Studies on the etiology of typhus fever in north China. Chinese Med. J. 53: 513-538.

_____, and Feng, L. C., 1936. Studies on the development of Spirochaeta recurrentis in body louse. A preliminary report. Chinese Med. J. 50(9): 1181-1184.

_____, _____, 1938. Studies on the development of the Chinese strain of Spirochaeta recurrentis in Cimex lectularius. Chinese Med. J. Suppl. 2: 563-577.

_____, _____, 1939. Natural infection of Phlebotomus chinensis in Peiping with Leishmania flagellates. Chinese Med. J. 56: 47-51.

_____, _____, 1941. Further observations on natural infection of Phlebotomus chinensis with Leishmania flagellates. Chinese Med. J. 59: 540-542.

_____, and Lee, C. U., 1935. Cysticercosis cellulosae in man with special reference to involvement of central nervous system. Chinese Med. J. 49(5): 429-445.

_____, and Li, T. C., 1940. The occurrence of canine leishmaniasis in kala-azar villages in the suburbs of Peiping. Chinese Med. J. 58: 661-670.

_____, and Wang, C. W., 1939. The immunity to infection with Leishmania canis of hamsters recently cured of Leishmania donovani infection. Chinese Med. J. 56: 519-522.

_____, _____, and Lee, C. U., 1944. Solustibosan in the treatment of kala-azar. Chinese Med. J.(Washington) 62(1): 17-25.

_____, _____, _____, and Liu, W. T., 1939. A report of the examination of 587 normal dogs in Peiping for Leishmania infection with observations on the experimental production of cutaneous lesions on a normal dog inoculated with a canine strain of Leishmania. Chinese Med. J. 56: 354-359.

_____, and Wei, Y. L., 1938. Studies on the transmission of relapsing fever in north China. II. Observations on the mechanism of transmission of relapsing fever in man. Am. J. Trop. Med. 18(6): 661-674.

Ciuca, M., 1932. Work of the Malaria Commission of the League of Nations. Chinese Med. J. 46: 412-424.

Clow, J. M., 1941. Shensi Province as an endemic focus of kala-azar. Preliminary report. Chinese Med. J. 59: 150-155.

_____, 1943. Report of a case of canine leishmaniasis. Chinese Med. J. 61A(2): 92-93.

_____, 1943. Kala-azar in Shensi Province. Chinese Med. J. 61A(4): 139-143; also Chinese Med. J. (Washington) 61(4): 281-290.

Cole, A. F., 1922. Five cases of Fasciolopsis infection, with remarks. China Med. J. 36(5): 391-397.

Cort, W. W., Grant, J. B. and Stoll, N. R., 1925. Hookworm disease in China. A preliminary report. Nat. Med. J. China 11(4): 282-297.

_____, _____, _____, et al. 1926. Researches on hookworm in China. Embodying the results of the work of the China Hookworm Commission, June 1923 to November, 1924. Am. J. Hyg. Monogr. Ser. No. 7. 398 pp.

_____, and Stoll, N. R., 1931. Studies on Ascaris lumbricoides and Trichuris trichiura in China. Am. J. Hyg. 14(3): 655-689.

Craig, C. F. and Faust, E. C., 1943. Clinical Parasitology. Philadelphia. 767 pp.

Crawford, W., 1930. Syphilis in west China. China Med. J. 44(11): 1129-1131.

Crook, R. L., 1939. Some notes on malaria in Szechwan. Chinese Med. J. 55: 465-478.

Cunningham, E. R., 1936. Blindness in west China. Chinese Med. J. 50(10): 1507-1512.

Curran, J. A. and Feng, G. T., 1930. A survey of human parasites of west central Shansi with a note on diphtheria. China Med. J. 44(9): 891-904.

Curtis, E. S., 1926. Report of a case of rat-bite fever. China Med. J. 40(2): 158-160.

Da Costa, P., 1935. An epidemiological and clinical study of a cerebro-spinal meningitis epidemic at Macao. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 2: 357-369.

Dang, M. G., Hemenway, R. V. and Lau, S., 1935. Report of nine hundred and sixty cases of malaria in Mintsing, Fukien. Chinese Med. J. 49(11): 1235-1240.

Davis, C. N., 1923. Dysentery in Shanghai: Recent research. China Med. J. 37(2): 107-115.

Davis, L. J., Guzar, J. S. and Fernando, F. S., 1935. Scarlatina immunity in Hong Kong. J. Hyg. (London) 35(2): 161-168.

De Haas, J. H., Sioe, K. T. and Hong, T. K., 1933. Tuberculine index van Chineesche schoolkinderen in Batavia. Geneesk. Tijdschrift Ned. Indië 73(15): 934-939.

Delbove, P., 1937. Le typhus murin à Saigon. Immunité croisée avec le typhus épidémique de Chine. Bull. Soc. Path. Exot. 30(8): 619-621.

Digby, K. H., Fook, W. L. and Loke, K. T., 1939. A case of typhoid periostitis. Caduceus 18(4): 272.

Dold, H., 1918. Über Pyozyaneus-Sepsis und Pyozyaneus-Darminfektion in Schanghai. Arch. Schiffs- u. Trop. Hyg. 20(22): 365-371.

Du, S. D., 1943. Kala-azar in Szechwan. Case reports II. Chinese Med. J. 61A(4): 150-151.

Du, S. D. and Best, A. E., 1931. Typhoid and paratyphoid fevers in Chengtu, Szechwan. China Med. J. 45(4): 325-331.

_____, _____, 1936. Kala-azar in west China. Chinese Med. J. 50(3): 273-277.

Dunlap, A. M., 1926. Chronic laryngeal stenosis complicating kala-azar and diphtheria. China Med. J. 40(5): 409-417.

Dzen, M. Y., 1928. Result of Dick test on normal persons in Peking, with statistics of test results from different investigators. Nat. Med. J. China 14(6): 362-367.

Fan, P. L., 1936. Dick test, Schick test and tuberculin test on the children of the rural districts of northern China. Public Health Monthly 2(3): 189-198. (In Chinese).

_____, 1937. Dick test among Chinese. Chinese Med. J. 51(6): 859-878.

_____, 1937. Control of diphtheria. Pt. 1: Schick test among Chinese. Pt. 2: Active immunization against diphtheria. Chinese Med. J. 51(6): 879-904.

_____, 1938. Diphtheria in infancy. Brief review of literature and report of a case with recovery. Chinese Med. J. 54(2): 173-176.

_____, 1939. The control of scarlet fever. Part 2. Active and passive immunization against scarlet fever. Chinese Med. J. 56: 532-547.

_____, and Chang, C. E., 1943. Kala-azar in Szechwan. Case reports IV. Chinese Med. J. 61A(4): 152.

_____, and Pi, C. C., 1943. Scarlet fever in Tsinan. An analysis of 309 cases. Chinese Med. J. 61A(2): 56-62.

Farner, D.S. and Katsampes, C. P., 1944. Tsutsugamushi disease. U. S. Naval Med. Bull. 43(4): 800-836.

Faust, E. C., 1921. Preliminary survey of the parasites of vertebrates of north China. China Med. J. 35(3): 196-210.

_____, 1922. A survey of the helminth parasites of man in north China. Trans. Fourth Congr. Far East. Ass. Trop. Med. Batavia 1: 476-481.

_____, 1922. Broncho-spirochaetosis in China. China Med. J. 36(1): 67-69.

_____, 1922. Present-day aspects of parasitology in China. China Med. J. 36(3): 253-255.

_____, 1923. A new type of amoeba parasite in man observed in north China. J. Parasit. 9: 221-226; also 1924, China Med. J. 38(4): 278-285. (1924).

_____, 1923. The oriental blood fluke in China. China J. Sci. Arts 1(2): 163-165.

_____, 1923. Notes on Embadomonas sinensis, Faust and Wassell, 1921. China Med. J. 37(3-4): 231-233.

_____, 1923. Parasitic infections as an economic loss to the community. Lingnan Agric. Rev. 1(2): 23-25.

_____, 1923. The possible incidence of river fever (tsutsugamushi disease) in the central Yangtze Valley. China Med. J. 37(12): 979-987.

Faust, E. C., 1923-24. Schistosomiasis in China: Biological and practical aspects. Proc. Roy. Soc. Med., Sec. Trop. Dis. Parasit. 17(3): 31-43.

_____, 1924. Observations on north China intestinal parasites of man, based on an intensive examination of patients in a medical ward of the Peking Union Medical College Hospital. Am. J. Trop. Med. 4(4): 411-437.

_____, 1924. The reactions of the miracidia of Schistosoma japonicum and S. haematobium in the presence of their intermediate hosts. China Med. J. 38(11): 906-913.

_____, 1925. Some recent aspects of the epidemiology of Clonorchis infection in China. China Med. J. 39(4): 287-296.

_____, 1925. On a case of triradiate Taenia solium from north China. China Med. J. 39(9): 800-804.

_____, 1926. A preliminary check list of the mosquitoes of the Sino-Japanese areas. China Med. J. 40(2): 142-143.

_____, 1926. Parasitic infections and human disease in China. Arch. Path. Lab. Med. 2(2): 223-240.

_____, 1926. An inquiry into the prevalence of malaria in China. China Med.J. 40(10):937-956.

_____, 1928. Report for the Parasitology Diagnostic Laboratory of the Peking Union Medical College Hospital for the year 1927-1928. China Med. J. 42(11): 823-826.

_____, 1929. Human intestinal parasites in north China. Am. J. Hyg. 9(2): 505-508.

_____, 1929. Mosquitoes in China and their potential relationship to human disease. J. Trop. Med. Hyg. 32(10): 133-137.

_____, 1930. The animal parasites of man and mammals in Fukien Province, China. Proc. Nat. Hist. Soc. Fukien Christian Univ. 3: 7-10.

_____, et al., 1939. Comparative efficiency of various technics for the diagnosis of protozoa and helminths in feces. J. Parasit. 25(3): 241-262.

_____, Campbell, H. E. and Kellogg, C. R., 1929. Morphological and biological studies on the species of Diphyllobothrium in China. Am. J. Hyg. 9(3): 560-583.

_____, and Kellogg, C. R., 1929. Parasitic infections in the Foochow area, Fukien Province, China. J. Trop. Med. Hyg. 32: 105-110.

_____, and Khaw, O. K., 1927. Studies on Clonorchis sinensis (Cobbold). Am. J. Hyg. Monogr. Ser. No. 8. 284 pp.

_____, and Lo, K. C., 1928. A new case of Isospora hominis from China. J. Parasit. 14: 197.

_____, and Meleney, H. E., 1924. Studies on schistosomiasis japonica. Am. J. Hyg. Monogr. Ser. No. 3.

_____, and Wassell, C. M., 1921. Preliminary survey of the intestinal parasites of man in the central Yangtze Valley. China Med. J. 35: 532-561.

Feng, H. H., 1934. Cysticercus cellulosae subconjunctivalis. Report of a case. Chinese Med. J. 48(9): 863-868.

Feng, L. C., 1930. Experiments with Dirofilaria immitis and local species of mosquitoes in Peiping, north China. Ann. Trop. Med. Parasit. 24(3): 347-362.

_____, 1931. Filariasis in China with special reference to its distribution and transmission. Nat. Med. J. China 17(4): 464-474.

_____, 1931. The larvae and pupae of the north China species of Anopheles; their structure and breeding habits. Nat. Med. J. China 17(4): 493-512.

_____, 1931. Anopheles hyrcanus var. sinensis Wied., transmitter of Wuchereria (Filaria) bancrofti in Woosung District, Shanghai, China. Am. J. Hyg. 14(2): 502-514.

_____, 1932. Anopheles hyrcanus var. sinensis Wied., transmitter of Filaria bancrofti in Woosung District, Shanghai, China. A preliminary report. Trans. Eighth Congr. Far East. Ass. Trop. Med. Siam (1930) 2: 189-193.

_____, 1932. Investigations on malaria and its transmission in Amoy, Fukien Province, south China. J. Trop. Med. Hyg. 35: 198-202; 214-221.

_____, 1933. Household mosquitoes and human filariasis in Amoy, south China. Chinese Med. J. 47(2): 168-178.

_____, 1933. A comparative study of the anatomy of Microfilaria malayi Brug, 1927, and Microfilaria bancrofti Cobbold, 1877. Chinese Med. J. 47(11): 1214-1246.

_____, 1933. A brief mosquito survey in some parts of central China. Chinese Med. J. 47(12): 1347-1358.

_____, 1934. Intermediate hosts of Microfilaria malayi in Chekiang, China. Proc. Soc. Exp. Biol. Med. 32(3): 494-496.

_____, 1935. Some experiments with mosquitoes and Microfilaria malayi in Huchow (Chekiang, China). Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 1: 491-494.

_____, 1935. Notes on some mosquitoes collected from Shangtung Province, north China. Chinese Med. J. 49(4): 359-365.

_____, 1935. The present status of the knowledge of the mosquitoes of China and their relation to human diseases. Chinese Med. J. 49(11): 1183-1208.

_____, 1936. The development of Microfilaria malayi in A. hyrcanus var. sinensis Wied. Chinese Med. J. Suppl. 1: 345-367.

_____, 1936. Malaria and its transmission in Kwangsi, China. Chinese Med. J. 50(12): 1799-1814.

_____, 1937. The malaria problem in Kwangtung and Kwangsi. Public Health Monthly 2(7): 517-530. (In Chinese).

_____, 1937. The hibernation mechanism of mosquitoes. Arch. Schiffs- u. Trop. Hyg. 41(3): 331-337.

_____, 1937. The anopheline mosquitoes and the epidemiology of malaria in China. Chinese Med. J. 51: 1005-1020.

_____, 1938. A critical review of literature regarding the records of mosquitoes in China. Part 1. Subfamily Culicinae, Tribe Anophelini. Part 2. Subfamily Culicinae, Tribes Megarhinini and Culicini. Peking Nat. Hist. Bull. 12(3): 169-181; (4): 285-318.

Feng, L. C., 1938. The tree-hole species of mosquitoes of Peiping, China. Chinese Med. J. Suppl. 2: 503-525.

_____, 1939. Geographical distribution of mosquitoes in China. VII. Internat. Kongr. Ent. (1938) 3: 1579-1588.

_____, 1940. The egg of Anopheles (Myzomyia) pattoni Christophers. Chinese Med. J. Suppl. 3: 300-303.

_____, and Chin, Y. T., 1937. The presence of Anopheles maculipennis in certain parts of Manchuria. Chinese Med. J. 51(4): 496-499.

_____, and Chung, H. L., 1937. Attempts to infect Ornithodorus moubata with the Chinese strain of Spirochaeta recurrentis. Proc. Soc. Exp. Biol. Med. 36(3): 330-333.

_____, _____, 1939. The development of Leishmania in Chinese sandflies fed on dogs with canine leishmaniasis. Chinese Med. J. 56: 35-46.

_____, _____, and Hoeppli, R., 1939. Canine leishmaniasis with skin lesions observed in Peiping. Chinese Med. J. 55: 371-382.

_____, and Yao, K. F., 1935. Observations on filariasis in Huchow, Chekiang, China. Chinese Med. J. 49(8): 797-801.

Forkner, C. E. and Zia, L. S., 1935. An outline of the development of the theories for the transmission of leishmaniasis together with further evidence to support a theory of direct transmission of kala-azar through the agency of oral and nasal secretions. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 1: 633-656.

Fournier, J., 1939. Deux cas de septicémie à Salmonella cholerae suis à Chang-hai (Concession Française). Bull. Soc. Path. Exot. 32(10): 914-918.

_____, 1940. Sur quelques caractères de vibrions cholériques isolés à Changhai en temps d'épidémie. Chinese Med. J. Suppl. 3: 431-438.

Fowler, H., 1925. A survey of leprosy in China. China Med. J. 39(7): 584-590.

Fraser, S. N. D., 1933. Out-patient leprosy work. Chinese Med. J. 47(3): 257-262.

_____, 1936. The Iam Tsau Clinic for patients suffering from leprosy. Chinese Med. J. 50(5): 693-701.

Frazier, C. N., 1925. Hongkong foot. China Med. J. 39(8): 705-711.

_____, 1926. Tinea capitis in a Chinese orphanage. China Med. J. 40(6): 558-562.

_____, and Mu, J. W., 1936. The incidence and nature of acute meningitis in early syphilis and its relation to arsphenamine therapy. A study of 169 cases observed in Peiping. Chinese Med. J. 50(11): 1591-1608.

Fu, C. L., 1935. Epidemic of malaria in Chiang-lo, Fukien Province. Health Semimonthly 2(4): 7-17. (In Chinese).

Furonaka, F., Masuda, K. and Tamura, J., 1929. Beiträge zu den Untersuchungen bei Typhus abdominalis. J. Chosen Med. Ass. 19(4): 545-564.

Gajdos, E. and Tchang, J., 1934. Le gonflement scrotal du cobaye dans le typhus exanthématique expérimental de Chine. Arch. Inst. Pasteur Tunis 23(1): 37-42.

Gajdos, S. and Tchang, J., 1933. Researches concerning typhus in north China. Chinese Med. J. 47(5): 441-451.

Galliard, H., 1939. Culicides du Yunnan. Annales Parasit. 17(3): 261.

Galt, C. M., 1925. Rat-bite fever. Report of a case. China Med. J. 39(11): 1029.

_____, 1928. Diseases prevalent in Kiulungkiang, Yunnan. China Med. J. 42(6): 420-422.

_____, 1931. Leprosy in Yunnan. China Med. J. 45(9): 867-868.

Gaschen, H., 1935. Faune entomologique des voies d'accès au Yunnan. Bull. Soc. Path. Exot. 28(3): 194-198.

Gear, H. S., 1933. Epidemiological survey of hospital patients: Interim report. Chinese Med. J. 47(9): 864-876.

_____, 1934. The incidence of disease in selected hospitals in China for 1933. Chinese Medical Association Hospital Survey. Chinese Med. J. 48: 758-782.

_____, 1935. Tuberculosis in China: Incidence of the various types. Chinese Med. J. 49(5): 446-461.

_____, 1935. The incidence of venereal diseases in hospital patients in China. Chinese Med. J. 49(10): 1122-1135.

_____, 1936. A note on malaria in China. Chinese Medical Association Hospital Survey. Chinese Med. J. 50(2): 131-136.

_____, 1936. Disease incidence in China. An analysis of hospital records for 1934. Chinese Medical Association Hospital Survey. Chinese Med. J. 50(7): 949-972.

_____, 1937. Epidemiological notes on scarlet fever in China. Chinese Med. J. 51: 203-210.

_____, and Pedersen, H., 1935. Some diseases common to man and animals in China. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 2: 305-323.

Gin, S. Y., 1935. Some observations on a preliminary study of beri-beri in Shanghai. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 2: 407-413.

Goddard, F. W., 1919. Fasciolopsis buski, a parasite of man as seen in Shaohing, China. J. Parasit. 5(4): 141-163.

Goodwin, T. S., 1930. Paragonimus westermanii infection. China Med. J. 44(6): 568.

Gossard, J. E., 1920. Anti-cholera campaign in Foochow. China Med. J. 34(6): 667-668.

Grant, J. B. and Yuan, I. C., 1932. A note on the forces of mortality and their classification in Peiping. Chinese Med. J. 46(12): 1187-1189.

Gressitt, J. L., 1941. Amphibians and reptiles from southeastern China. Philippine J. Sci. 75(1): 1-60.

Hall, G. A. M., 1926. A case of amoebiasis of the lung. China Med. J. 40(7): 644-646.

Halpern, F.G. and Tseng, J. C., 1938. The incidence of syphilis and neuro-syphilis among the Chinese. Chinese Med. J. 53: 281-286.

Heanley, C. N., 1908. The age incidence of 109 cases of Opisthorchis sinensis infection in Cantonese: Its small pathological importance. J. Trop. Med. Hyg. 11: 38-39.

Heimburger, L. F., 1927. The incidence of syphilis at the Shantung Christian University Dispensary. China Med. J. 41(6): 541-550.

_____, and Yu, W. Y., 1930. Treatment of leprosy in Tsinan Leper Hospital. China Med. J. 44(8): 752-758.

Hemenway, R. V., 1930. One hundred malarial cases. China Med. J. 44(11): 1118-1123.

_____, 1934. Results of the De Rivas treatment in dysentery cases. Chinese Med. J. 48(4): 337-341.

Herklots, G. A. C., 1933. Land snakes of Hong Kong, I. Hong Kong Naturalist 4(2): 113-126.

Hicks, E. P., 1927. The relation of rat-fleas to plague in Shanghai. J. Hyg. (London) 26(2): 163-169.

_____, and Robertson, R. C., 1927. The occurrence of paratyphoid C in Shanghai. China Med. J. 41(9): 789-793.

Hindle, E., 1928. Further observations on Chinese kala-azar. Proc. Roy. Soc. London Ser. B. 103 (B 727): 599-619.

_____, and Feng, L. C., 1929. Experiments with malaria and mosquitoes in Shantung, China, with a note on the value of local species of fish for the destruction of mosquito larvae. Trans. Roy. Soc. Trop. Med. Hyg. 23(1): 71-80.

_____, Hou, P. C. and Patton, W. S., 1926. Reports from the Royal Society's Kala Azar Commission in China. No. 1. Serological studies on Chinese kala-azar. Proc. Roy. Soc. London Ser. B. 100 (B 704): 368-373.

_____, and Patton, W. S., 1926. Reports from the Royal Society's Kala Azar Commission in China. No. 2. Experiments bearing on the susceptibility of the striped hamster (Cricetulus griseus) to Leishmania of Chinese kala-azar. No. 4. Resistance of Leishmania to cold. Proc. Roy. Soc. London Ser. B. 100 (B 704): 374-379; 385-386.

Hiroki, H., 1934. Plague epidemic at Nungan in Kirin Province, Manchuria, in 1933. J. Oriental Med. 21(2): 227-275.

Hirose, T., 1929. Dysentery in Tsingtao, with special reference to the child cases. J. Chosen Med. Ass. 19(11): 1455-1458. (In Japanese).

Hiyeda, K., 1932. Distribution of parasitic diseases in Manchuria. J. Oriental Med. 16(2): 343-353. (In Japanese).

_____, 1935. On the distribution of parasites and parasitic diseases in Manchuria. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 2: 557-562.

Ho, C., 1931. Study of the adult culicides of Peiping. Bull. Fan Mem. Inst.Biol.2(8):107-175.

_____, 1932. Notes on sarcophagid flies with description of new species. I. Albiceps group. Bull. Fan Mem. Inst. Biol. 3(19): 345-360.

_____, 1935. On the blood-sucking Muscidae of Peiping. Bull. Fan Mem. Inst. Biol. (Zool. Ser.) 6(5): 185-206.

_____, 1938. On a collection of anopheline mosquitoes from the Island of Hainan. Ann. Trop. Med. Parasit. 32(4): 387-411.

Ho, E. A., 1939. A note on the coincidence of human kala-azar and canine leishmaniasis with cutaneous lesions in a household. Chinese Med. J. 55: 566-567.

Hoeppli, R., 1940. The epidemiology of kala-azar in China. Chinese Med. J. 57: 364-372.

Hogg, A., 1918. Scarlet fever in Chefoo schools. China Med. J. 32: 239-241.

Hong, L. Y. and Ono, H., 1935. Über die epidemischen Typen der Dysenteriebacillen im Jahre 1933 in Shanghai. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 1: 163-168.

Hoshi, N., 1926. On the fever and bacillus type of dysentery and ekiri in children in Manchuria. J. Oriental Med. 4(3): 64-65.

Hou, P. C., 1943. An investigation of kala-azar and sand-fly incidence in an endemic kala-azar area in the western part of Szechwan. Chinese Med. J. 61A(4): 152-153; also Chinese Med. J.(Washington) 61(4): 279-280.

Houghton, H. S., 1910. A study of ascites and splenomegaly. China Med. J. 24(4): 244-256.

Howard, H. J., 1924. The eradication of trachoma among school children in China. China Med. J. 38(4): 255-270.

Hsieh, T. Y., Chang, S. L. and Yang, C. S., 1937. Typhus fever in Changsha. Chinese Med. J. 52: 383-388.

Hsü, H. F., 1936. Check list. Parasitic helminths of animals and man in China. Chinese Med. J. Suppl. 1: 457-473.

_____, 1938. Schistosoma turkestanicum in north China. Chinese Med. J. 54(6): 568-570.

_____, 1940. Euparyphium jassyense Leon and Ciurea (= E. melis (Schrank)) found at the autopsy of a Chinese. Chinese Med. J. 58: 552-555.

_____, and Chow, C. Y., 1937. Studies on certain problems of Clonorchis sinensis. II. Investigation in the chief endemic center of China, the Canton area. Chinese Med. J. 51(3): 341-356.

_____, _____, 1938. Studies of human intestinal helminths in 809 autopsy cases. Bull. Fan Mem. Inst. Biol.(Zool. Ser.) 8(3): 245-273.

_____, Fan, Y. C., Tan, C. C. and Chin, K. Y., 1940. Two cases of heavy infestation by Ascaris lumbricoides. Chinese Med. J. 57: 168-175.

_____, and Hoeppli, R., 1938. Miscellaneous observations on ten species of parasitic nematodes. Chinese Med. J. Suppl. 2: 451-460.

_____, and Khaw, O. K., 1936. Studies on certain problems of Clonorchis sinensis. I. On the cysts and second intermediate hosts of C. sinensis in the Peiping area. Chinese Med. J. 50: 1609-1620.

_____, _____, 1937. Studies on certain problems of Clonorchis sinensis. III. On the morphology of the metacercaria. Festschrift Bernhard Nocht: 216-220.

_____, and Li, S. Y., 1940. Studies on certain problems of Clonorchis sinensis. VIII. Experimental proof of Bithynia longicornis as the first intermediate host of C. sinensis. IX. The migration route of its early larval stages in the snail, Bithynia fuchsiana. Chinese Med. J. Suppl. 3: 241-243; 244-254.

Hsü, H. F. and Li, S. Y., 1941. Helminths of dogs in Peiping. Peking Nat. Hist. Bull. 15(3): 201-213.

_____, and Wang, L. S. 1938. Studies on certain problems of Clonorchis sinensis. IV. Notes on the resistance of cysts in fish flesh, the migration route, and the morphology of the young worm in the final host. Chinese Med. J. Suppl. 2: 385-400.

Hsu, I. M., 1925. An analysis of G. U. cases from the clinic of St. Luke's Hospital, Shanghai. Nat. Med. J. China 11(1): 27-31.

Hsu, K. C., 1943. Human intestinal parasites in northwest China. A brief survey. Chinese Med. J. 61A(4): 174-176; also Chinese Med. J.(Washington) 61(4): 292-295.

Hsu, K. L., 1936. Scarlet fever in Canton. Chinese Med. J. 50(4): 405-409.

Hsu, S. C. and Ke, C. T., 1937. An investigation of 19 communicable diseases in China. Chinese Med. J. 51(6): 833-850.

_____, and Wang, T. H., 1935. Investigation of the deaths of infants in Nanking. Public Health Monthly 1(4): 23-27. (In Chinese).

Hu, C. K., Frazier, C. N. and Hsieh, C. K., 1939. Syphilis of lung, a report of three cases observed in north China. Chinese Med. J. 56: 431-440.

_____, Khaw, O. K. and Frazier, C. N., 1930. Subcutaneous cysticercosis cellulosae in man. A report of five cases. Arch. Derm. Syph. 21(5): 777-789.

_____, Kurotchkin, T. J. and Frazier, C. N., 1932. Observations on the treatment of tinea capitis with thallium acetate. Chinese Med. J. 46(1): 23-30.

Hu, S. M. K., 1934. An examination of prisoners at Paoshan, Kiangsu Province, for microfilariae of Wuchereria bancrofti Cobbold. Chinese Med. J. 48(11): 1143-1145.

_____, 1935. Preliminary observations on the longevity of infective larvae of Wuchereria bancrofti Cobbold in Culex pipiens var. pallens Coquillett. Chinese Med.J.49(6):529-536.

_____, 1935. Experimental infection of Culex fatigans Wiedemann from Foochow, Fukien Province, with Wuchereria bancrofti Cobbold. Lingnan Sci. J. 14(1): 87-92.

_____, 1935. Notes on the relative adult density of Anopheles hyrcanus var. sinensis Wiedemann during 1933 with reference to malaria incidence in Kaochiao, Shanghai area. Chinese Med. J. 49(5): 469-474.

_____, 1935. Studies on the susceptibility of Shanghai mosquitoes to experimental infection with Wuchereria bancrofti Cobbold. I. Aëdes albopictus Skuse. II. Armigeres obturbans Walker. III. Culex tritaeniorhynchus Giles. IV. Aëdes vexans var. nipponii Theobald. Peking Nat. Hist. Bull. 9(4): 249-254; 255-260. 10(1): 39-43. 10(2): 127-131.

_____, 1935. The house-frequenting behavior of Anopheles hyrcanus var. sinensis Wiedemann in the Shanghai area. Pt. 1. Time of entry. Lingnan Sci. J. 14(3): 385-394.

_____, 1937. Notes on the filarial infection of Culex pipiens var. pallens Coq. in relation to the microfilarial density of the blood. Lingnan Sci. J. 16(3): 409-414.

_____, 1937. Experiments on repeated infections of filarial larvae in Culex pipiens var. pallens Coq. Peking Nat. Hist. Bull. 12(1): 13-18.

Hu, S. M. K., 1937. A brief mosquito survey of Foochow region, south China. Lingnan Sci. J. 16(4): 579-584.

_____, 1938. Studies on the susceptibility of Shanghai mosquitoes to experimental infection with Wuchereria bancrofti Cobbold. V. Culex fuscanus Wiedemann. VI. Culex vagans Wiedemann. Peking Nat. Hist. Bull. 13(1): 39-52. 13(2): 113-116.

_____, 1938. Observations on the zoophilism of Anopheles hyrcanus var. sinensis Wied. in the Shanghai region. Comptes Rendus X. Congr. Far East. Ass. Trop. Med. Hanoi 2: 873-888.

_____, 1939. The house-frequenting behavior of Anopheles hyrcanus var. sinensis Wiedemann in the Shanghai area. Pt. 2. Time of exit. Lingnan Sci. J. 18(2): 133-142.

_____, 1939. Preliminary observations on the effects of filarial infection on Culex pipiens var. pallens Coq. Chinese Med. J. 55: 154-161.

_____, 1939. Observations of the development of filarial larvae during the winter season in Shanghai region. Am. J. Hyg. 29(2): 67-74.

_____, 1939. Studies on the susceptibility of Shanghai mosquitoes to experimental infection with Wuchereria bancrofti Cobbold. VII. Culex vorax Edwards. VIII. Culex bitaeniorhynchus Giles. IX. Anopheles hyrcanus var. sinensis Wiedemann. Peking Nat. Hist. Bull. 13(4): 287-292. 14(1): 15-22. 14(2): 83-97.

_____, 1940. The house-frequenting behavior of Anopheles hyrcanus var. sinensis Wiedemann in the Shanghai area. Pt. 3. Indoor resting places. Lingnan Sci. J. 19(3): 403-410.

_____, 1940. Culex pallidothorax Theobald as a carrier of Wuchereria bancrofti Cobbold. Lingnan Sci. J. 19(4): 543-547.

_____, 1940. Studies on the susceptibility of Shanghai mosquitoes to experimental infection with Microfilaria malayi Brug. I. Culex pipiens var. pallens Coquillett. II. Culex tritaeniorhynchus Giles. III. Anopheles hyrcanus var. sinensis Wiedemann. Peking Nat. Hist. Bull. 15(1): 87-91. 15(2): 93-96; 97-101.

_____, 1941. Studies on the susceptibility of Shanghai mosquitoes to experimental infection with Microfilaria malayi Brug. IV. Culex vorax Edwards. V. Armigeres obturbans Walker. VI. Aëdes albopictus Skuse. Peking Nat. Hist. Bull. 15(3):215-216. 16(1):55-65; 67-70.

_____, and Chang, T. L., 1933. Observations on natural infection of Culex pipiens Linnaeus var. pallens Coquillett with Wuchereria bancrofti Cobbold in Woosung district, Shanghai, China. Chinese Med. J. 47(12): 1367-1372.

_____, Kong, H. and Li, B. C., 1937. A brief survey of filariasis in Foochow and Futsing regions, south China. Chinese Med. J. 52: 571-578.

_____, and Yen, C. H., 1933. Studies on the susceptibility of Culex pipiens Linnaeus var. pallens Coquillett to experimental infection with Wuchereria bancrofti Cobbold in Shanghai area. Chinese Med. J. 47(12): 1359-1366.

_____, _____, 1935. Studies on the comparative susceptibility of Culex pipiens var. pallens Coquillett and Culex fatigans Wiedemann to experimental infection with Wuchereria bancrofti Cobbold. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 1: 483-490.

Hu, S. M. K. and Yu, H., 1936. Preliminary studies on the blood preferences of Anopheles hyrcanus var. sinensis Wiedemann in Shanghai region. Chinese Med. J. Suppl. 1:379-386.

_____, _____, 1937. Further studies on the blood preferences of Anopheles hyrcanus var. sinensis Wied. in Shanghai region. Chinese Med. J. 51(5): 639-642.

Hua, T. J. and Cheng, S. Y., 1940. Clinical report of two cases of blackwater fever from Chun Wan, New Territories (Hong Kong). Caduceus 19(2): 96-99.

Huang, C. H., 1940. Acute agranulocytosis in kala-azar. Chinese Med. J. 57: 119-140.

_____, 1941. The neutralization of Japanese encephalitis virus by serum. Chinese Med. J. 59(1): 34-44.

_____, Chang, H. C. and Lieu, V. T., 1937. Salmonella infection. A study of 17 cases of S. enteritidis septicemia. Chinese Med. J. 52: 345-366.

_____, and Liu, S. H., 1940. Acute epidemic encephalitis of Japanese type, clinical report of six proven cases. Chinese Med. J. 58: 427-439.

Huang, C. Y., 1943. Kala-azar in Szechwan. Case reports I. Chinese Med. J. 61A(4): 150.

Huang, T. F., 1927. Communicable disease information in China. Nat.Med.J.China 13(1):92-108.

Hueck, O., 1935. Über Lepra-Behandlung in der Canton-Provinz. Arch. Schiffs- u. Trop. Hyg. 39(11): 464-474.

_____, and Wan, H. F., 1936. A note on the treatment of Clonorchis sinensis with fouadin. Chinese Med. J. 50(9): 1281-1282.

Huizenga, L. S., 1923. Bronchial spirochaetosis. China Med. J. 37(2): 153-157.

_____, 1923. Forty cases of typhoid fever. China Med. J. 37(3-4): 320.

_____, 1938. Leprosy problem in Matang Hsiang, Jukao Hsien, Kiangsu. Chinese Med. J. 53: 287-289.

Imudzu, K. et al., 1941. Report on the health conditions of the immigrant farmers in Tich-li-hien, Pei-an Province of Manchuria in 1941. Kyoto Ikadaigaku Zasshi (Mitteil. Med. Akad. Kioto) 31(1): 1-56. (In Japanese).

Ishii, N. and Tei, T. W., 1931. Studies on the frequency of parasites and their connection with vegetables in Amoy, China. Taiwan Igakkai Zassi (J.Med.Ass.Formosa) 30(8):829-844. (In Japanese with English summary).

Ishii, S., 1929. Human and dog cases of Fasciolopsis buski in Canton, China. Taiwan Igakkai Zassi (J. Med. Ass. Formosa) 288: 242-246. (In Japanese w.English summary).

_____, et al. 1929. Statistical observations of the intestinal parasites in Amoy. Taiwan Igakkai Zassi (J. Med. Ass. Formosa) 297: 25-26. (In Japanese).

Ishii, W., 1940. Studies on kala-azar. Report 1. Japanese J. Exp. Med. 18(3): 137-147.

Iwata, M., 1927. Reminiscence of plague-prevention work in north China. J. Publ. Health Ass. Japan 3(11): 24-31. (In Japanese).

Jackson, R. B., 1932. A brief account of mosquitoes. Their life history and the diseases which they carry, with special reference to Hong Kong. Hong Kong Naturalist 3(3-4): 207-215.

_____, 1932. Mosquitoes. Caduceus 11(2): 83-91.

_____, 1935. The anophelines of the colony of Hong Kong. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 1: 27-36.

_____, 1935. Sur deux cas d'infection naturelle, par l'hématozoaire du paludisme, de A. splendidus (A. maculipalpis) dans la colonie de Hong-Kong. Bull. Soc. Path. Exot. 28(6): 446-448.

_____, 1936. Investigations into the habits and pathogenicity of the Anopheles met with in two localities in Hong Kong during 1931-1935. Chinese Med. J. 50(8): 1098-1113.

_____, 1936. Some observations on the occurrence of filarial infection in mosquito and man in the colony of Hong Kong. Chinese Med. J. 50(12): 1767-1772.

_____, 1938. A guide to the identification of the anopheline larvae of the colony of Hong Kong, with notes concerning them. Chinese Med. J. 53: 259-270; 563-576.

_____, 1938. Notes on Ae. (E.) togoi Yamada as met with in the colony of Hong Kong. Chinese Med. J. 54(6): 559-562.

Jarvis, B. W. and Kang, T., 1935. Some observations of beri-beri in Fukien Province with special reference to Foochow. Chinese Med. J. 49(10): 1150-1155.

Jefferys, W. H. and Maxwell, J. L., 1911. The Diseases of China including Formosa and Korea. 2nd ed. by J. L. Maxwell, Shanghai, 1929.

Jettmar, H. M., 1932. Beiträge zur Epidemiologie der Malaria und Pest im Fernen Osten. Zentralbl. Bakter. 127(1-3): 178-184.

_____, 1940. Some experiments on the resistance of the larvae of latrine fly, Chrysomyia megacephala, against chemicals. Chinese Med. J. 57: 74-85.

Johnstone, I. L., 1934. Note on malaria epidemic in Honan, 1931. Chinese Med. J. 48(1):56-58.

Jordan, J., 1937. Mosquito larvicidal measures. Chinese Med. J. 51(6): 927-936.

Jouveau-Dubreuil, H., 1919. Tokelau (tinea imbricata) in Szechwan. China Med. J. 33(3): 223-229.

_____, 1919. Note on an epidemic of cerebro-spinal meningitis at Chengtu (Szechwan). China Med. J. 33(4): 321-323.

Judson, H. A., 1920. Encephalitis lethargica in Hwaiyuan. China Med. J. 34: 373-376.

Kan, H. C., 1936. Intracutaneous test with Schistosoma japonicum antigen. Chinese Med. J. Suppl. 1: 387-393.

_____, 1941. Prevalence of malaria in Kweichow Province. Chinese Med. J. 59: 77-83.

_____, and Kung, J. C., 1936. Incidence of schistosomiasis japonica in an endemic area in Chekiang. Chinese Med. J. Suppl. 1: 449-456.

Kan, H. C. and Kung, Y. T., 1936. Schistosomiasis-infected area in Chekiang Province. Public Health Monthly 2(3): 177-183. (In Chinese).

_____, and Yao, Y. T., 1934. Some notes on the anti-schistosomiasis japonica campaign in Chih-Huai-Pan, Kaihua, Chekiang. Chinese Med. J. 48(4): 323-336.

Kao, C. L., 1940. Tuberculosis in children in Shanghai. Chinese Med. J. 58: 113-123.

Kao, Y. E., 1936. The incidence of various diseases among children in Moukden. Chinese Med. J. 50(4): 466-477.

_____, 1936. Cerebro-spinal meningitis in Moukden. Chinese Med. J. 50(4): 478-490.

Katahira, J., 1926. A report of infectious diseases in Canton District. Taiwan Igakkai Zassi (J. Med. Ass. Formosa) 260: 1043-1071. (In Japanese).

Kato, Y., Hanawa, C., Ueda, H., Orishikemu, T., 1909. The hygienic conditions of the oversea ports visited by the fleet of three battleships from January 25 to August 2, 1909. Kaigun Iji Hôkoku Saigô (Rep. Med. Bureau Naval Dept. Japan) 52: 77-127. (In Japanese).

Kau, L. S. 1936. Histological studies of splenomegaly, with special reference to material from the Foochow area. Chinese Med. J. 50(11): 1577-1584.

Kawaguchi, Z., 1914. Hygienic conditions of Kiukiang, China. Kaigun Iji Hôkoku Saigô (Rep. Med. Bureau Naval Dept. Japan) 61: 231-238. (In Japanese).

Kawana, H., 1936. Study on Clonorchis sinensis in the district of Shanghai. III. Dogs, cats and rats as reservoir hosts of Clonorchis. J. Shanghai Sci. Inst. (Sec. 4) 2: 75-84.

_____, 1940. Study on the development of the excretory system of Fasciola hepatica L., with special reference of its first intermediate host in central China. J. Shanghai Sci. Inst. (Sec 4) 5: 13-34.

Kawana, K., 1935. Carriers of Clonorchis sinensis in Shanghai. First report. Dobutsugaku Zasshi (Monthly Publ. Zool. Soc. Japan) 47(No.557):202-203. (In Japanese).

Kessel, J. F., 1925. The distinguishing characteristics of the intestinal protozoa of man. A syllabus for clinicians. China Med. J. 39(2): 85-122.

_____, and Svensson, R., 1924. A survey of human intestinal protozoa in Peking, China. China Med. J. 38(12): 961-982.

Khaw, O. K., 1930. Remarks on the species of Paragonimus with special reference to the questions of their identity and distribution. Nat. Med. J. China 16(1): 93-102.

_____, 1931. Historical notes on Fasciolopsis buski (Lankester, 1857) Odhner, 1902. Nat. Med. J. China 17(4): 475-487.

_____, 1931. Transmission of kala-azar to hamsters (Cricetulus griseus) by feeding them with infected carcasses. Nat. Med. J. China 17(4): 599-616.

_____, 1931. A survey of Peiping latrines for intestinal parasites. Nat. Med. J. China 17(4): 622-643.

_____, Hoeppli, R., 1931. Ekto- und Endoparasiten chinesischer Bettler in Peiping. Arch. Schiffs- u. Trop. Hyg. 35(8): 443-448.

Khaw, O. K. and Kan, H. C., 1934. Some observations on the prevalence of malaria in Nanking and its vicinity. Chinese Med. J. 48(2): 109-123.

Kiang, S. M., 1936. Bilateral metastatic ophthalmia complicating epidemic cerebro-spinal meningitis. Report of a case. Chinese Med. J. 50(10): 1498-1499.

Kiao, Y. S., 1927. Circular medical service along the Taonan-Angangchi railway. Chines. Zeitschr. Ges. Med. 5(1): 44-47. (In Chinese).

Kikuta, K., 1937. Investigation of rickettsiosis in Manchuria. J. Oriental Med. 27(3): 389-408.

King, G. E., 1919. Medical notes from Kansu. China Med. J. 33(1): 38-40.

_____, 1925. Kansuh and its diseases. China Med. J. 39(1): 19-22.

King, P. Z., 1943. Epidemic prevention and control in China. Chinese Med. J. (Washington) 61(1): 47-54.

_____, and Hsu, S. C., 1941. A general review of our emergency health administration. Nat. Med. J. China 27(3): 133-146. (In Chinese).

Knowles, R., White Sr., R., Das Gupta, B. M., 1930. Studies in the parasitology of malaria. Indian Med. Res. Mem. No 18. 436 pp.

Koba, K., 1938. Some notes on Agkistrodon halys (Pallas) from Syôryûzan Island, Kwangtung, south Manchuria. Dobutsugaku Zasshi (Zool. Mag. Japan) 50(5): 245-264. (In Japanese with English summary).

Kobayashi, E., 1940. Studies on the trematoda of Hainan Island. (Abstract). Taiwan Igakkai Zassi (J. Med. Ass. Formosa) 39(6): 876. (In Japanese).

Kobayashi, H., 1931. Fishes in Japan as intermediate hosts of intestinal parasites. J. Chosen Nat. Hist. Soc. 12: 1-9. (In Japanese).

_____, Yokoi, K. and Kawabe, K., 1940. Parasitological investigations in Hainan-Island. I. Epidemiological studies on malaria and splenomegaly among the natives of Hainan Island, south China. II. Examination of the helminthic eggs and larvae attached to various vegetables in Hoi-how. III. The incidence of intestinal parasites among the natives in Hoi-how and Keisan, Hainan-Island, south China. Taiwan Igakkai Zassi (J. Med. Ass. Formosa) 39(3): 409-419; 404-408. 39(4): 429-443. (In Japanese with English summary).

Kodama, M., Kawano, M., Takahashi, K. and Honma, H., 1933. Experimental studies on the possibility of interchanging the properties of Rickettsia manchuriae and Rickettsia prowazeki through natural and artificial passage through louse and flea. Trans. Soc. Path. Japonicae 23: 754-755. (In Japanese).

_____, Kono, M. and Takahashi, K., 1932. Demonstration of Rickettsia manchuriae appearing in the stomach epithelial cells of rat fleas and rat lice infected with so-called Manchurian typhus. Kitasato Arch. Exp. Med. 9(2): 91-96.

_____, Takahashi, K. and Kono, M., 1932. On experimental observation of the so-called Manchurian typhus and its etiological agent (Rickettsia manchuriae). Kitasato Arch. Exp. Med. 9(2): 97-133.

Koide, T., 1914. Hygienic conditions of Foochow and Ma-wei, China. Kaigun Iji Hôkoku Saigô (Rep. Med. Bureau Naval Dept. Japan) 61: 147-184. (In Japanese).

Komiya, Y., 1936. Study on Clonorchis sinensis in the district of Shanghai. 2. On the habit of eating fresh water fish among the Japanese in Shanghai. J. Shanghai Sci. Inst. (Sec. 4) 2: 61-73.

Komiya, Y. and Kawana, H., 1936. Study on Clonorchis sinensis in the district of Shanghai. IV. The second intermediate hosts of Clonorchis. J. Shanghai Sci. Inst. (Sec. 4) 2: 155-167.

_____, _____, and Tao, S. C., 1935. Study on Clonorchis sinensis in the district of Shanghai. I. Epidemiology of human clonorchiasis. J. Shanghai Sci. Inst.(Sec.4) 1: 271-292.

_____, _____, _____, 1935. Investigations into helminthiasis among Japanese pupils in Shanghai. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 1: 611-617.

_____, _____, _____, 1936. On the prevalence of helminthiasis among the Japanese and Chinese in the district of Shanghai. I. Results of examinations of helminths ova among the Chinese children and students. II. Results of examinations of helminths ova among the Japanese and Chinese servants and cooks in restaurants and cafes. III. Results of examinations of helminths ova among the Japanese primary school children. IV. Results of examinations of helminths ova among the Japanese students of the Girls High School, Commercial School and Tung Wen College. J. Shanghai Sci.Inst.(Sec.4)2:85-107;117-154.

_____, and Tajimi, T., 1940. Study on Clonorchis sinensis in the district of Shanghai. V. The cercaria and metacercaria of Clonorchis sinensis with special reference to their excretory system. VI. The life cycle of Exorchis oviformis with special reference to the similarity of its larval forms to that of Clonorchis sinensis. J. Shanghai Sci. Inst. (Sec. 4) 5: 91-106; 109-123.

Koo, C., Dzao, P. V. and Young, M. P., 1929. Wassermann reports. China Med.J. 43(10):1017-1018.

Koo, S. Y., 1941. Trichinosis among hogs and rats in Fukien. Nat.Med.J.China 27(6): 349-350.

Koo, U. K., 1922. Paragonimiasis with report of a case. Nat. Med. J. China 8(4): 259-263.

_____, 1924. Enteric fevers and their complications as seen in St. Luke's Hospital. Nat. Med. J. China 10(6): 382-386.

Korns, J. H., 1925. Incidence of tuberculous infection in China. China Med. J. 39(1): 10-19.

Kuan, Y. M., 1930. An investigation on scarlet fever in China. Internat. Med. J. 10(7): 49-55. (In Chinese).

Kubota, K., 1940. Über die Salmonellatypen in Kwangchow Shih, Südchina. Taiwan Igakkai Zassi (J. Med. Ass. Formosa) 39(9): 1538-1548. (In Japanese with German summary).

_____, 1941. The 1939 Asiatic cholera epidemic in Kwangchowshih. Taiwan Igakkai Zassi (J. Med. Ass. Formosa) 40(6): 1070-1097. (In Japanese with English summary).

Kung, H. W., 1928. A brief history of the public health work in Harbin. Nat. Med. J. China 14(4): 281-296. (In Chinese).

Kurachi, K., 1930. Epidemiology of plague in inner Mongolia. Plague studies I. J. Oriental Med. 12(4): 569-596. (In Japanese with English summary).

_____, 1931. The rodents of inner Mongolia. Plague studies II. Kitasato Arch.Exp.Med. 8:39-59.

Kuroya, M. and Hong, L. Y., 1935. Types of dysentery bacilli epidemic in Shanghai in 1933 and 1934. Bull. Shanghai Sci. Inst. 4: 153-178. (In Japanese).

_____, and Ono, H., 1933. On the types of cholera Vibrio of the Shanghai epidemic of 1932. (Second report). J. Shanghai Sci. Inst. (Sec. 4) 1: 41-68.

_____, and Oshio, K., 1932. On the types of cholera Vibrio of the Shanghai epidemic of 1932. (First report). J. Shanghai Sci. Inst. (Sec. 4) 1: 1-18.

_____, Yong, S., Tang, L. C. and Hong, L. Y., 1939. Kala-azar in Pi-Hsien District, Kiangsu Province, China. I. The blood picture and the sedimentation rate of red blood cells in kala-azar. J. Shanghai Sci. Inst. (Sec. 4) 4: 165-227.

Kuttner, A. G. and T'ung, T., 1936. Encephalitis in north China. Results obtained with neutralization tests. J. Clin. Invest. 15(5): 525-530.

Lai, D. G., 1931. The Schick test on Chinese students in Shanghai. A report of 1698 cases. China Med. J. 45(2): 139-144.

_____, 1931. The Dick test on Chinese students in Shanghai. China Med. J. 45(8): 749-757.

_____, and Chang, T. S., 1930. Syphilis and prostitution in Kiangsu. China Med. J. 44(6): 558-563.

_____, and Huang, Y. K., 1929. Notes on diseases of the Hakkas. China Med.J. 43(2): 104-110.

_____, Kao, C. L. and Chien, P. N., 1934. Incidence of tuberculous infection among the Chinese in Shanghai. Chinese Med. J. 48(8): 750-757.

_____, and Lai, S. W., 1928. Incidence of syphilis among the Chinese soldiers at Swatow. China Med. J. 42(8): 557-567.

_____, _____, 1928. The Kahn reaction in leprosy. A study of 167 lepers in Swatow District. China Med. J. 42(12): 880-883.

_____, _____, 1929. Incidence of syphilis among Chinese civilian patients in Swatow District. China Med. J. 43(1): 22-27.

_____, Li, Y. J. and Chang, W., 1935. A malaria survey in Kao-Chiao, Shanghai. Chinese Med. J. 49(5): 462-468.

Lamson, H. D., 1935. Social Pathology in China, a Source Book for the Study of Problems of Livelihood, Health,and the Family. Shanghai. 607 pp.

Landauer, E., 1938. Rapport sur la peste dans l'Ile de Hainan. Bull. Soc. Path. Exot. 31(9): 752-760.

Lee, C. U., 1926. Filariasis investigations in the province of Kiang Su, China. Trans. Roy. Soc. Trop. Med. Hyg. 20(4): 279-287.

_____, 1937. Canine leishmaniasis in Peiping. Chinese Med. J. 51: 951-952.

_____, and Chung, L. H., 1935. A clinical study of the early manifestations of Chinese kala-azar. Chinese Med. J. 49(12): 1281-1300.

_____, and Meleney, H. E., 1927. Malaria in a village near Peking. China Med. J. 41(12): 989-992.

_____, _____, 1928. Tertian malaria in a village near Peking. J. Parasit. 14: 196.

Lee, E. L., 1940. Tuberculosis in China. Journal-Lancet 60(4): 145-146.

Lee, T'., 1935. Some statistics on medical schools in China for the year 1933-1934. Chinese Med. J. 49(9): 894-902.

_____, 1936. A short history of the acute infectious diseases in China. Chinese Med. J. 50(2): 172-183.

Lee, Y., 1934. Über Askarideninfektion und ihre Bekämpfung. Arch. Schiffs- u. Trop. Hyg. 38(9): 390-394.

Leger, M., 1931. Les causes de la cécité en Chine. Bull. Soc. Path. Exot. 24(4): 255-265.

Lennox, W. G., 1919. Some vital statistics, based on the histories of 4,000 Chinese families. China Med. J. 33(4): 325-345.

_____, 1920. Lethargic encephalitis in Peking. China Med. J. 34: 376-378.

Lenox, J. E., Lenox, C., Chen, L. C., Crook, R. L. and Kao, E., 1943. Kala-azar in Sikong Province. Chinese Med. J. 61A(4): 149; also Chinese Med.J.(Washington)61(4): 291.

Leo, T. L., 1935. A case of paragonimiasis. Chinese Med. J. 49(8): 784-788.

Li, C. P. and Ni, Y. Y., 1928. A case of B. enteritidis septicemia. J. Infect. Dis. 42(3): 226-229.

Li, F. C., 1932. Anatomy of a Chinese species of intermediate host of Schistosoma japonicum. Science 16(4): 566-582. (In Chinese).

_____, 1932. Über die postembryonale Entwicklung von dem Zwischenwirt des Schistosomum hämatobium japonicum in China. Science 16(4): 583-619. (In Chinese).

_____, 1934. Anatomie, Entwicklungsgeschichte, Oecologie and Rassenbestimmung von Oncomelania, des Zwischenwirtes von Schistosoma japonicum (Katsurada, 1904) in China. Trans. Sci. Soc. China 8(2): 103-145.

_____, 1934. Beobachtung über die Biologie von Oncomelania, des Zwischenwirtes von Schistosoma japonicum in China. Arch. Schiffs- u. Trop. Hyg. 38(12): 519-524.

_____, 1935. Beobachtung über die embryonale Entwicklung von einigen Süsswasserschnecken. Chinese J. Zool. 1: 117-124.

_____, 1936. Eine neue species der Oncomelania. Chinese J. Zool. 2: 81-84.

_____, and Li, C. S., 1943. Kala-azar in Sian. Chinese Med. J. 61A(4): 144.

Li, F. S., 1934. Utilization of domestic animals as a means of prophylaxis in human malaria. Ent. and Phytopath. (Hangchow) 2(28): 548-552. (In Chinese).

_____, and Wu, S. C., 1933. A preliminary survey of malaria and anophelines in Hangchow. 1932 Year Book Bureau Ent.(Hangchow) 2: 323-331 (In Chinese).

_____, _____, 1933. A list of aquatic plants, fishes and insects collected in Hangchow, 1932. Ent. and Pytopath. (Hangchow) 1(36): 781-786.

_____, _____, 1934. The classification of mature larvae of Chinese anopheline mosquitoes. Ent. and Pytopath. (Hangchow) 2: 3-14; 22-32; 43-52; 62-66; 82-93. (In Chinese).

_____, _____, 1934. On the known species of Chinese Aëdes (Diptera, Culicidae). Ent. and Pytopath. (Hangchow) 2(35): 682-688. (In Chinese).

_____, _____, 1934. The mosquitoes of Hangchow, Chekiang. 1933 Year Book Bureau Ent.(Hangchow) 3: 97-123.

_____, _____, 1934. Observations of the life history of Anopheles hyrcanus var. sinensis and investigation of mosquitoes in the mosquito net. 1933 Year Book Ent.(Hangchow) 3: 154-162. (In Chinese with English summary).

Li, F. S. and Wu, S. C., 1935. On the known species of Chinese Culicini, with a few other species. Ent. and Pytopath. (Hangchow) 3(3-5): 44-90. (In Chinese).

_____, _____, 1935. Breeding places of the mosquitoes in Hangchow. 1934 Year Book Bureau Ent.(Hangchow) 4: 33-36.

_____, _____, 1935. Notes on the morphology of culicine larvae in Hangchow. 1934 Year Book Bureau Ent.(Hangchow) 4: 95-102.

Li, K. H., 1924. Incidence of parasitic helminths in Soochow. A preliminary report. Nat. Med. J. China 10(1): 7-19.

_____, 1924. Malaria among Chinese university students. China Med. J. 38(9): 737-742.

_____, 1939. Tetanus. Report of a case. Chinese Med. J. 56: 576-577.

_____, 1940. Some epidemiological observations on scarlet fever in Peiping. Chinese Med. J. 58: 234-244.

Li, P. A., 1928. Epidemic jaundice. Nat. Med. J. China 14(1): 18-20. (In Chinese).

Li, S., Lang, C. W. and Zia, S. H., 1938. Brucella agglutinin in sera of Peiping Chinese. Chinese Med. J. Suppl. 2: 297-305.

Li, T. A., 1924. The death rate of Hongkong as a criterion of mortality in China. Nat. Med. J. China 10(1): 25-32.

_____, 1934. The campaign against tuberculosis with special reference to the inauguration of the National Anti-Tuberculosis Association in China. Chinese Med.J. 48(3): 301-303.

Li, Y. and Chien, Y. C., 1942. Cecocolic intussusception in a case of schistosomiasis japonicum. Chinese Med. J. 61A(1): 25-28.

Liang, C. S., 1932. Taenia solium - report of a case. Chinese Med. J. 46(7): 676-678.

Libby, W. E., 1924. A further study in schistosomiasis japonica. China Med.J. 38(5):376-388.

Lin, C., 1924. Report on the fecal examinations for intestinal parasites in the National Peking Medical College, 1923. Nat. Med. J. China 10(2): 112-154; 10(3): 195-245. (In Chinese).

Lin, C. S. and Jettmar, H. M., 1925. The scarlet fever problem in the Far East. Nat. Med. J. China 11(6): 399-412.

_____, and Wu, L. T., 1927. Report of a preliminary health survey of Pinchiang (Chinese City of Harbin) January - June 1926. Nat. Med. J. China 13(1): 24-82.

Lin, L. C., 1943. Kala-azar in Szechwan. Case reports III. Chinese Med. J. 61A(4): 151.

_____, Yao, Y. C., 1936. Intestinal parasite infection in Kweichow and Yunnan. Public Health Monthly 2(4): 331-333. (In Chinese).

Ling, C. C., 1940. Bacillus dysenteriae bacteremia, a report of two cases. Chinese Med. J. 58: 545-551.

Ling, H. C., Greene, L. and Pai, S. E., 1938. Diphtheria gravis bacteremia. Report of two cases. Chinese Med. J. 54(2): 177-181.

Ling, J. C. and Yao, Y. T., 1937. The importance of A. hyrcanus var. sinensis Wied. as a malaria carrier in China, based on the studies of its blood meal and maxillary teeth index. Peking Nat. Hist. Bull. 11(3): 191-198.

Ling, L. C., Liu, K. B. and Yao, Y. T., 1936. Studies on the so-called changch'i. Part 2. Changch'i in Yunnan. Chinese Med. J. 50(12): 1815-1828.

Liu, C. Y., 1936. Catalogue of Chinese Siphonaptera. Lingnan Sci.J. 15(3):379-390;(4):583-594.

_____, 1939. The fleas of China: Order Siphonaptera. Philippine J. Sci. 70(1): 1-122.

Liu, H. L., 1928. Report of a case of rat-bite fever. Nat. Med. J. China 14(4): 297-300.

_____, 1928. Rat bite fever. Report of a case. China Med. J. 42(12): 927-931.

_____, 1929. A case of schistosomiasis japonica complicated with amoebic dysentery. Nat. Med. J. China 15(1): 47-48.

_____, 1941. Balantidium infection in man. Report of a case from Chefoo. Chinese Med. J. 59: 476-479.

Liu, K., 1937. Filariasis in Changsha. Preliminary report. Chinese Med. J. 52: 579-582.

Liu, L. S., 1935. The prevalence of malaria among railroad workers at the Hunan Kwangtung border. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 2:159-164.

Liu, P. Y., 1938. Serological typing of Salmonella enteritidis isolated in Peiping. Chinese Med. J. Suppl. 2: 279-289.

_____, Zia, S. H. and Chung, H. L., 1937. Salmonella enteritidis infection by a parental route. Proc. Soc. Exp. Biol. Med. 37(1): 17-18.

Liu, W. T., 1943. Investigation of typhus in China. Chinese Med.J.(Washington)61(4):323-336.

_____, and Chung, H. L., 1939. Typhus virus isolated from rats and rat-fleas in typhus houses. Proc. Soc. Exp. Biol. Med. 40(3): 353-355.

_____, _____, and Wang, C. W., 1942. Typhus fever in Peiping; epidemiological considerations. Am. J. Hyg. 35: 231-250.

_____, _____, and Zia, S. H., 1940. Experimental studies on typhus virus in Peiping, with particular reference to a non-orchitic murine strain isolated from a patient. Chinese Med. J. Suppl. 3: 588-628.

_____, and Zia, S. H., 1941. Studies on the murine origin of typhus epidemics in north China. I. Murine typhus Rickettsia isolated from body lice in the garments of a sporadic case. II. Typhus Rickettsia isolated from mice and mouse-fleas during epidemic in a household and from body lice in garments of one of the epidemic cases. Am. J. Trop. Med. 21(4): 507-523; 21(5): 605-625.

Loucks, H. H., 1930. Hydatid cyst. A review and a report of cases from north China. Nat. Med. J. China 16(4): 402-496.

_____, 1935. Hydatid disease in China. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 1: 567-571.

Lowenberg, R. D., 1937. Notes on encephalitis in Shanghai. Chinese Med. J. 51(6): 989-1000.

Lu, T. H., 1933. The plague epidemic of 1931 in Shansi and Shensi Provinces (China). J. Oriental Med. 18(2): 249-264. (In Japanese with English summary).

Ludlow, A. I., 1926. Amebic liver abscess. China Med. J. 40(12): 1165-1189.

Ludlow, C. S., 1920. Siberian Anopheles. Psyche 27(4): 74-78.

Lui, K. T., 1941. Report of a case of blackwater fever. Caduceus 20(2): 128-130.

Ma, L. S., 1941. Notes on an epidemic relapsing fever in west Yunnan. Nat. Med. J. China 27: 420.

MacArthur, W. P., 1929. The adult mosquitoes of Shanghai. J.Roy.Army Med.Corps 52(4):241-247.

MacFarlane, H., 1915. The Stegomyia survey in Hong Kong. Bull. Ent. Res. 6(1): 67-68.

Malval, J. and Palud, Y., 1938. Le choléra de 1937 dans la Concession Française de Changhai. Bull. Soc. Path. Exot. 31(3): 205-212.

Manson, P., 1877. Report on the health of Amoy for the half-year ended 31st March 1877. Med. Rep. Imperial Maritime Customs 13: 12-38.

_____, 1877. Further observations on Filaria sanguinis hominis. Med. Rep. Imperial Maritime Customs 14: 1-26.

_____, 1882. Distoma ringeri. Med. Rep. Imperial Maritime Customs 20: 10-12.

Mao, W. S., 1939. Trachoma in Chengtu, Szechwan. Chinese Med. J. 56: 474-482.

Maxwell, J. L., 1928. Leprosy, the problem and its eradication in China. China Med. J. 42(12): 869-879.
*

_____, 1931. Paragonimiasis in China. A preliminary report. China Med. J. 45(1): 43-49.

_____, 1931. Notes on the incidence of leprosy in the less known areas. China Med. J. 45(9): 875-876.

_____, 1937. A statistical review of 1379 cases of leprosy in China. Internat. J. Leprosy 5(2): 151-157.

Maxwell, J. P., 1916. Undulant and paratyphoid fevers in Fukien Province. China Med. J. 30: 100-103.

_____, 1921. Intestinal parasitism in south Fukien. China Med. J. 35: 377-382.

_____, 1921. Filariasis in China. Philippine J. Sci. 19(3): 257-327.

May, W. K. C., 1939. The treatment of tetanus. Report of a case of local tetanus. Chinese Med. J. 56: 569-575.

McAll, P. L., 1936. Epidemics of cerebro-spinal meningitis. Chinese Med. J. 50(8): 1133.

McCartney, J. H., 1910. Report of three unusual cases. China Med. J. 24(5): 351.

McClelland, H. F. H., 1941. Notes on an endemic centre of kala-azar in the Province of Hupeh, central China. Chinese Med. J. 60: 87-89.

* Maxwell, J. L., 1929. See Jefferys, W. H. and Maxwell, J. L., 1911.

McClure, W. B., 1931. The diagnosis of obscure fevers in south China. China Med. J. 45(8): 758-778.

McCoy, O. R. and Chu, T. C., 1937. Fasciolopsis buski infection among school children in Shaohsing and treatment with hexylresorcinol. Chinese Med. J. 51(6): 937-944.

McKinsky, R. N. and Zia, F. D., 1925. Cholera cases treated in the Municipal Isolation Hospital for Chinese, Shanghai, 1925. Nat. Med. J. China 11(6): 434-439.

Mei, P. F. and Chou, T. Q., 1938. Two poisonous plants, huang-t'eng and tsai-chung-yao, and their identification. Chinese Med. J. 54(1): 37-39.

Meleney, H. E., 1924. The intermediate host of Schistosoma japonicum in China. III. Further observations on its distribution. China Med. J. 38(6): 481-485.

_____, 1925. Schistosomiase et kala-azar en Chine. Bull. Soc. Path. Exot. 18(5): 364-368.

_____, 1927. The types of breeding places used by Anopheles hyrcanus in north and central China. China Med. J. 41(4): 347-350.

_____, and Faust, E. C., 1923. The intermediate host of Schistosoma japonicum in China. I. Its discovery in the Soochow region. China Med. J. 37(7): 541-545.

_____, Lee, C. U. and Chang, H. L., 1927. A preliminary survey of the anopheline mosquitoes of the Peking area. China Med. J. 41(6): 509-512.

_____, _____, and Yang, C. P., 1928. Experiments with anti-mosquito measures at Yenching. China Med. J. 42(10): 725-736.

Mell, R., 1929. List of Chinese snakes. Lingnan Sci. J. 8: 199-219.

Meng, C. H. and Winfield, G. F., 1938. Studies on the control of fecal-borne diseases in north China. V. A preliminary study of the density, species, make-up, and breeding habits of the house-frequenting fly population of Tsinan, Shangtung, China. Chinese Med. J. Suppl. 2: 463-486.

_____, _____, 1941. Studies on the control of fecal-borne diseases in north China. XIII. An approach to the quantitative study of the house frequenting fly population. A. The estimation of trapping rates. XIV. B. The characteristics of an urban fly population. Peking Nat. Hist. Bull. 15(4): 317-331; 333-351.

_____, _____, 1942-1943. Studies on the control of fecal-borne diseases in north China. XV. An approach to the quantitative study of the house frequenting fly population. C. The characteristics of a rural fly population. XVI. D. The breeding habits of the common north China flies. XVIII. E. The food preferences of the common north China flies. XVIII. F. A preliminary study of the life histories of Musca vicina Macquart and Chrysomya megacephala Fabricius. Chinese Med. J. 61A(1): 18-19. (2): 54-55. (3): 104. (4): 161-165.

Mi, C. H. and Yang, C. T., 1937. Kala-azar in Nanchang. Chinese Med. J. 51: 669-670.

Mills, R. G., 1923. Notes on the occurrence of Taenia saginata in north China. J. Parasit. 9: 214-220; also China Med. J. 37(11): 932-939.

_____, 1924. Notes on the occurrence of Taenia solium and Cysticercus cellulosae in north China. China Med. J. 38(6): 465-471.

Montschadsky, A., 1936. Les Larves des Moustiques (Fam. Culicidae) de l'URSS et des Pays Limitrophes. Moscow & Leningrad. 383 pp. (In Russian).

Mora, A. D. and Soares, J. C., 1936. Leprosy in Macao. Some comments by the Portuguese doctors of Macao. Chinese Med. J. 50(5): 721-725.

Morgan, J., 1927. Intestinal parasitism in Tsinan, as observed in 1273 routine feces examinations during a period of 17 months. China Med. J. 41(10): 847-852.

Morishita, K., 1936. Classification of the Formosan anophelines, with a key to species. Trans. Nat. Hist. Soc. Formosa 26: 347-355.

_____, 1936. On the species of Formosan anophelines. Dobutsugaku Zasshi (Monthly Publ. Zool. Soc. Japan) 48(8-9-10): 573-579. (In Japanese with English summary).

Moriwaki, G., 1928. Scarlet fever rash and toxin of hemolytic streptococci. China Med. J. 42(4): 286-296.

Morris, H. H., 1928. Mercurochrome in the treatment of typhoid fever. China Med. J. 42(5): 369-373.

_____, 1931. Kala-azar from southern Kiangsu. China Med. J. 45(12): 1180-1181.

Mu, J. W. and Kurotchkin, T. J., 1939. Statistical and mycological studies of dermatomycoses observed in Peiping. Chinese Med. J. 55: 201-219.

Mühlens, P., 1937. "Yangtse-Fieber"-Erkrankungen (Schistosomiasis japonica) an Bord eines deutschen Handelsschiffes. Arch. Schiffs- u. Trop. Hyg. 41(2): 308-317.

Nagano, K., 1925. Studies on the problems of Clonorchis sinensis. Trans. Sixth Congr. Far East. Ass. Trop. Med. Tokyo 1: 379-385.

Nakamura, H., 1930. Litmus agar medium for the isolation of dysentery bacilli. J. Oriental Med. 12(4): 485-491. (In Japanese with English summary).

Nauck, E. G., 1928. Epidemiologie und Tropenkrankheiten in China. Arch. Schiffs- u. Trop. Hyg. 32 Beiheft 5: 1-83.

Neumann, L. G., 1911. Ixodidae. Königl. Preuss. Akademie d. Wiss. Berlin. XV & 169 pp.

New, W. S., 1934. Acute anterior poliomyelitis in China. A brief note on epidemiology. Chinese Med. J. 48(2): 142-143.

Nieh, C. E., 1936. Systemic infection with B. pyocyaneus. A review of literature and a report of seven cases. Chinese Med. J. 50(12): 1751-1758.

Nishimura, H., 1938. On the types of cholera of Shanghai epidemic of 1937. J. Shanghai Sci. Inst. (Sec. 4) 3: 251-268.

Nuttall, G. H. F. and Warburton, C., 1908-1926. Ticks. A Monograph of the Ixodoidea. Cambridge, England. Pt.1. The Argasidae. 1908. Pt.2. The Ixodidae. 1911. Pt.3. The Ixodidae. 1915. Pt.4. The Genus Amblyomma by L. E. Robinson. 1926.

Oda, K., Shindo, C., Nishihara, H., 1940. On types of cholera Vibrio isolated in Shanghai in 1938. First report. Bull.Naval Med.Ass.Tokyo 29(2):115-119. (In Japanese with English summary).

Okubo, S., 1935. On the gas gangrene bacilli isolated from the soil around Shanghai. Bull. Naval Med. Ass. Tokyo 24: 132-139. (In Japanese with English summary).

Oldt, F., 1926. Hookworm in Kwong Tung and some suggestions for its eradication. China Med. J. 40(3): 240-248.

_____, 1927. Is Clonorchis a health menace in China? China Med. J. 41(3): 185-206

Oldt, F., 1933. Tuberculosis in Kwangtung according to age, sex, occupation and economic condition. Chinese Med. J. 47(2): 111-127.

Olitsky, P. K., 1919. Report on the investigations of the outbreak of epidemic meningitis in Hongkong. China Med. J. 33(4): 309-321; (5): 413-432.

Opie, E. L., 1939. Tuberculosis of first infection in adults from rural districts of China. Chinese Med. J. 56: 216-224.

Oppenheim, F., 1925. Über die Häufigkeit einzelner Befunde bei 100 in Shanghai ausgeführten Chinesen-Sektionen. Tung-Chi Med. Monatsschr. 1(3): 105-125.

Otto, J. H., 1935. Clinical pathophysiological and therapeutical aspects of human clonorchiasis. Trans. Ninth Congr.Far East.Ass.Trop.Med. Nanking (1934) 1: 543-561.

_____, 1937. Zur Frage der roentgenologischen Erkennbarkeit krankhafter Veränderung am Magendarmkanal bei Patienten mit Opisthorchis sinensis. Arch. Schiffs- u. Trop. Hyg. 41(2): 296-303.

_____, 1937. Über den chinesischen Leberegel Opisthorchis sinensis. Zur Entstehung, Erkennung und Behandlung der durch ihn bedingten Krankheit. Arch. Schiffs- u. Trop. Hyg. 41(7): 481-505; (8): 562-565.

Ouyang, G., 1940. Acute bacillary dysentery in infants and children; an analysis of 315 cases. Chinese Med. J. 58: 456-472.

Pan, J. S., 1935. A statistical study of 268 cases of typhoid and paratyphoid fever in St. Andrew's Hospital, Wusih, from 1928-1934. Chinese Med. J. 49(7): 658-661.

_____, 1937. Malaria in Wusih. Chinese Med. J. 51(6): 971-978.

Pang, K. H., 1936. Die Bedeutung der Dysenterie für China und ihre Bekämpfung. Arch. Schiffs- u. Trop. Hyg. 40(10): 440-448.

_____, and Zia, S. H., 1940. Study on the cultural types of C. diphtheriae in Peiping. Chinese Med. J. Suppl. 3: 334-341.

Park, W. H., 1900. Report on the health of Soochow for the three years ended 31st March 1900. Med. Rep. Imperial Maritime Customs 59: 5-8

Patton, W. S., 1926. Blood-sucking arthropods of medical and veterinary importance in China. China Med. J. 40: 543-553; 603-612.

_____, and Hindle, E., 1926. Reports from the Royal Society's Kala Azar Commission in China. No. 3. Notes on kala-azar in Shantung. No. 5. Notes on three new parasites of the striped hamster (Cricetulus griseus). No. 6. Notes on the species of sandflies (Genus Phlebotomus) of north China. Proc. Roy. Soc. London Ser. B. 100 (B 704); 379-384; 387-390; 405-412.

_____, _____, 1927. The development of Chinese Leishmania in Phlebotomus major var. chinensis and P. sergenti var. Proc. Roy. Soc. London Ser. B. 101 (B 710): 369-390.

_____, _____, 1928. The north Chinese species of the genus Phlebotomus (Diptera, Psychodidae). Proc. Roy. Soc. London Ser. B. 102 (B 720): 533-551.

Pearce, R., 1939. The distribution of leprosy in north west China. Leprosy Rev. 10(4):201-206.

Pearson, G. H., 1935. A warning note on malaria in Hunan. Chinese Med. J. 49(3): 288-289.

_____, and Yang, C. T., 1938. Hookworm in Shaoyang, Hunan. Chinese Med. J. 54(6): 574-578.

Pfister, O. M., 1929. Prevalence of encephalitis epidemica in China. China Med. J. 43: 963.

Pi, H. T., 1936. Trachoma in China. Chinese Med. J. 50(10): 1465-1485.

Pillat, A., 1929. About the trachoma problem in China. China Med. J. 43(2): 87-102.

Pollitzer, R. and Li, C. C., 1943. Some observations on the decline of pneumonic plague epidemics. Chinese Med. J. (Washington) 61(3): 212-216.

_____, Yao, H. Y., Lai, D. G. and Chen, S. K., 1941. The 1939 cholera epidemic in Yunnan Province, with special reference to Kunming City. Chinese Med. J. 59: 457-467.

Pope, C. H., 1929. A list of reptiles known to occur in Fukien Province, China. Proc. Nat. Hist. Soc. Fukien Christian Univ. 2: 20-22.

_____, 1935. The Reptiles of China, Turtles, Crocodilians, Snakes and Lizards. Natural History of Central Asia, Vol. 10. New York. III & 604 pp.

Rappleye, W. C. et al., 1939. Epidemic Encephalitis, Etiology, Epidemiology, Treatment. (Third report by the Matheson Commission). New York. VIII & 493 pp.

Raynal, J., 1936. Sur une nouvelle espèce de phlébotome du nord de la Chine, Phlebotomus khawi, n. sp. Annales Parasit. 14(6): 529-540.

_____, 1938. Note préliminaire sur le typhus exanthématique à Chang-hai (Concession Française). Bull. Soc. Path. Exot. 31(4): 256-258.

_____, 1940. Le typhus murin à Chang-hai. Bull. Soc. Path. Exot. 33(3): 168-175.

_____, 1942. Exanthematic fever in Shanghai. Proc. Sixth Congr. Pacific Sci. Ass. (1939) V.5: 695-705.

_____, and Fournier, J., 1939. Sur les virus de typhus exanthématique isolés à Changhaï en 1938. Bull. Soc. Path. Exot. 32(5): 525-536.

_____, _____, 1939. Le typhus exanthématique de Chang-hai. Bull.Soc.Path.Exot. 32(6):636-642.

_____, _____, and Velliot, B., 1939. Research on typhus in Shanghai. Chinese Med. J. 56(1): 11-28.

_____, Lieou, Y., 1938. Sur l'épidémie de choléra de Changhai en 1937 (Concession Française). Bull. Soc. Path. Exot. 31(3): 201-205.

Reiss, F., 1929. Ringworm and public health. China Med. J. 43(3): 244-254.

_____, 1929. Leprosy. China Med. J. 43(5): 479-484.

Rennie, T., 1881. Report on the health of Foochow for the year ended 31st March 1881. Med. Rep. Imperial Maritime Customs 21: 50-56.

Reynes, V., Richard, J., 1940. Sur un cas de typhus tropical avec réactions de Bordet-Wassermann transitoirement positives. Bull. Soc. Path. Exot. 33(6-10): 363-366.

Ride, L., Ling, K. D., Lim, E. Q.and Cheng, S. Y., 1938. On the occurrence of oedema among cholera convalescents. Caduceus 17(3): 135-152.

_____, _____, _____, _____, 1938. Some biochemical aspects of acute cholera. Caduceus 17(4): 175-201.

Riley, W. A., 1932. An annotated list of Canton, China, mosquitoes, based on collections by the late C. W. Howard. Lingnan Sci. J. 11(1): 25-35.

_____, 1932. Anopheline mosquitoes from the Island of Hainan, China. Lingnan Sci.J.11(3):468.

_____, and Chen, H. T., 1932. Notes on fleas of Canton, China, rats. Lingnan Sci. J. 11(3): 445-448.

_____, _____, 1932. Trichinosis in China: Negative results of examination of pigs and rats at Canton. Lingnan Sci. J. 11(3): 465-467.

_____, and Wu, L. Y., 1932. The anopheline mosquitoes in China. Lingnan Sci. J. 11(2):175-191.

Robertson, R. C., 1932. Relapsing fever in Shanghai (first report). Chinese Med. J. 46(9): 853-885.

_____, 1933. Schistosomiasis in the Shanghai region. China J. 19(1): 28-37.

_____, 1936. The breeding conditions of Oncomelania hupensis (Rissoidae:Triculinae). Lingnan Sci. J. 15: 55-56.

_____, 1936. Schistosomiasis in the Foochow area. Chinese Med. J. 50(11): 1555-1560.

_____, 1936. The transmission in China of helminths by vegetables. Chinese Med. J. Suppl. 1: 418-422.

_____, 1940. Malaria in western Yunnan with reference to the China-Burma highway. Chinese Med. J. 57(1): 57-73.

_____, 1940. Schistosomiasis in the Tali-fu region of Yunnan Province. Chinese Med. J. 57(4): 358-363.

_____, 1940. An investigation into the causation of leucopenia in typhoid fever. Caduceus 19(2): 73-77.

_____, and Chang, T. L., 1940. Malaria survey in western Yunnan, Lungling area and Lushih County. Chinese Med. J. 58: 446-455.

_____, and Hu, S. M. K., 1937. The fly menace in Shanghai. China J. 27(4): 193-206.

_____, and Pollitzer, R., 1939. Cholera in central China during 1938 - its epidemiology and control. Trans. Roy. Soc. Trop. Med. Hyg. 33(2): 213-232.

Robinson, H. L., 1929. Some observations made during an outbreak of epidemic jaundice. Lintsing, Shantung, 1928. China Med. J. 43(2): 118-122.

Rohow, F. M., 1931. Undulant fever in China. Report of a typical case. U. S. Naval Med. Bull. 29(4): 664-667.

Rose, G. und Koh, T. M., 1935. Beobachtungen über die Fortpflanzung und die Lebensweise der Zwischenwirtschnecke (Oncomelania hupensis) von Schistosoma japonicum unter Laboratoriumsbedingungen. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 1: 525-534.

_____, Wang, B. L., 1937. Beobachtungen aus 7 Jahren über das Vorkommen von Malaria tertiana, Malaria tropica und Malaria quartana in Hangchow und einigen Plätzen Chekiangs. Arch. Schiffs- u. Trop. Hyg. 41(1): 131-153.

Roubaud, E., 1925. Une nouvelle espèce de puce-chique pénétrante, parasite des rats en Chine: Dermatophilus lagrangei n. sp. Bull. Soc. Path. Exot. 18(5): 399-405.

Russell, P. F., Rozeboom, L. E. and Stone, A., 1943. Keys to the Anopheline Mosquitoes of the World. With Notes on their Identification, Distribution, Biology and Relation to Malaria. Philadelphia. 152 pp.

Sato, T., 1940. Small-pox epidemic in Shanghai. J. Publ. Health Ass. Japan 16(2): 69-88.

_____, Aoki, M., 1914. Hygienic conditions of Kiao-chow Bay (Tsingtao, China). Kaigun Iji Hôkoku Saigô (Rep. Med. Bureau Naval Dept. Japan) 62: 298-311, (In Japanese).

Schretzenmayr, A., 1938. Extension du domaine géographique du kala-azar. (Apparition d'une épidémie à Canton.) Rev. Méd.Franç. d'Extrême-Orient 20(7): 868-877.

_____, Chue, S., Tsen, H. W., 1938. Kala-azar-Epidemie im bisher Kala-azar-freien Canton. Arch. Schiffs- u. Trop. Hyg. 42(10): 459-468.

_____, and Lancaster, R. L., 1938. Sternal puncture, with special reference to its application to tropical diseases in China. J. Trop. Med. Hyg. 41: 341.

Scott, A. V., 1924. A typical case of meningococcic meningitis. China Med. J. 38(11):915-917.

_____, 1936. Tuberculosis in Chinese children, some observations made in Cheeloo University Hospital and Clinic. Chinese Med. J. 50(4): 520-523.

_____, 1937. Tuberculosis incidence among Chinese children. Chinese Med. J. 51(6): 851-858.

_____, 1938. Dysentery bacillemia. Chinese Med. J. 53(2): 193-194.

_____, 1938. Anterior poliomyelitis in China. Chinese Med. J. 54(5): 442-447.

_____, 1943. Tuberculosis: Incidence among Chinese children. Chinese Med. J.(Washington) 61(2): 117-122.

_____, Fan, P. L. and Pi, C. C., 1943. Kala-azar in children - Shantung. Clinical analysis of 314 cases. Chinese Med. J. 61A(4): 145-149.

_____, P'i, C. C. and Lair, K. S., 1938. Disease incidence among Chinese children, observations from six hospitals. Chinese Med. J. 53(2): 169-184.

Scott, E. H., 1931. Leprosy in the Swatow District. China Med. J. 45(9): 869-874.

Scovel, F. G., 1944. Kala-azar: A review of its incidence and epidemiology in China and clinical observations on 585 cases. Ann. Int. Med. 21(o.s. 24)(4): 607-627.

Seaton, S. P., 1935. Blackwater fever in Hainan. Chinese Med. J. 49(8): 792-796.

Sharif, M., 1928. A revision of the Indian Ixodidae with special reference to the collection in the Indian Museum. Records of the Indian Museum 30(3): 217-344.

Shen, D. S., 1942. Tuberculosis of the conjunctiva, a case report. Chinese Med. J. 61A(1): 14-15.

Shibley, G. S., 1922. Summary of the case history of a patient. China Med. J. 36(5):418-420.

Shih, H. E. and Wen, C. C., 1939. Relapsing fever - clinical and statistical study of 337 cases. Chinese Med. J. 55(1): 6-33.

Shrimpton, E. A. G., 1936. A survey of the incidence of relapsing fever in China. Chinese Med. J. Suppl. 1: 312-344.

Sia, R. H. P., 1921. Routine Wassermann test on 502 in-patients. China Med. J. 35(1):39-42.

Siao, P. L., 1934. On the resistance of Sparganum mansoni and on the rate of its infection among edible frogs on Shanghai market. J. Shanghai Sci. Inst. (Sec.4) 1: 121-125.

Sinton, J. A., 1927. The identification and classification of the species of the genus Phlebotomus, with some remarks on their geographical distribution in relation to disease. Trans. Seventh Congr. Far East. Ass. Trop. Med. Calcutta 3: 172-181.

_____, 1928. The synonymy of the Asiatic species of Phlebotomus. Indian J. Med. Res. 16(2): 297-324.

_____, and Barraud, P. J., 1928. Improved methods for the identification of some species of Phlebotomus used in experimental work. Indian J. Med. Res. 16(2): 325-331.

Skinner, J. E., Trimble, C. G. and Chen, C. G., 1919. Relapsing fever in Fukien. China Med. J. 33(3): 210-212.

Smyly, H. J., 1920. A study of thirty-five cases of typhoid and paratyphoid. China Med. J. 34(2): 109-115.

_____, and Chang, K., 1936. Two cases of coccidiosis in man. Chinese Med. J. 50(9):1195-1202.

Snapper, I., 1940. Involvement of the nervous system in mumps. Chinese Med. J. 58: 79-87.

_____, Chung, H. L., Chu, I. and Chen, K. C., 1940. Preliminary observations on human, canine and murine leptospirosis in north China. Chinese Med. J. 58: 408-426.

Snell, J. A., 1920. Cholera in Soochow, 1919. China Med. J. 34: 253-258.

_____, 1929. Report of 3,000 routine Wassermann tests at the Soochow Hospital. China Med. J. 43(12): 1238-1241.

_____, and Chang, P. Y., 1921. Report of routine Wassermann test at Soochow Hospital for one year. China Med. J. 35(1): 36-39.

Sparrow, H., 1935. Étude d'un virus typhique d'origine humaine isolé en Mongolie. Arch. Inst. Pasteur Tunis 24(1): 56-64.

Stackleberg, A. A., 1937. Faune de l'URSS. Insectes Diptères. Vol. 3 No. 4. Fam. Culicidae (Subfam. Culicinae). Moscow & Leningrad. 258 pp. (In Russian).

Stanley, A., 1918. Scarlet fever in the Far East. China Med. J. 32(1): 1-6.

Stedeford, E. T. A., 1919. Public health of Wenchow, 1918-1919. China Med.J. 33(4):391-393.

Stevenson, P. H. and Tang, P. R., 1920. Some observations on epidemic cerebro-spinal meningitis. China Med. J. 34(5): 492-500.

Struthers, E. B., 1924. Kala-azar: Criterion of cure. China Med. J. 38(3): 207-212.

_____, and Ch'i, C. C., 1924. The globulin precipitation and formol-gel tests in the diagnosis of kala-azar. China Med. J. 38(3): 203-206.

Sturton, S. D., 1933. The problem of leprosy in Hangchow. Chinese Med. J. 47(3): 263-269.

Su, T. E., 1936. Encephalitis epidemica in Amoy. Chinese Med. J. 50(9): 1279-1280.

Su, T. F., 1936. Meningococcus meningitis in children. Report of an epidemic in Changsha, Hunan, 1935. Chinese Med. J. 50(4): 491-505.

Su, T. L. and Huang, T. F., 1937. Malaria as a rural social problem in the southwestern suburbs in Shanghai. Chinese Med. J. 51(6): 963-970.

Sun, C. J. and Chang, S., 1940. Notes on the kala-azar research in China. Pt. 2. The use of "distibinyl" in the treatment of Chinese kala-azar. Chinese Med. J. 57: 442-448.

_____, and Wu, C. C., 1937. Notes on the study of kala-azar transmission. Pt. 2. Further observations on the natural infection of Phlebotomus chinensis with Leptomonas donovani. Chinese Med. J. 52: 665-573.

_____, Yao, Y. T., Chu, H. J. and Wu, C. C., 1936. Natural infection of Phlebotomus chinensis with flagellates morphologically indistinguishable from those of Leishmania donovani. Chinese Med. J. 50(7): 911-916.

Sun, T. C. Y. and Thoroughman, J. C., 1939. Tuberculosis in a general hospital. Chinese Med. J. 56(1): 69-77.

_____, and Young, M. P., 1931. A report of 167 cases malaria treated in Elizabeth Banks Hospital during 1930. China Med. J. 45(3): 258-265.

Sweet, W. C., Feng, L. C., Chow, C. Y. and Hsu, S. C., 1942. Anophelines of southwestern Yunnan and their relation to malaria. J. Nat. Malaria Soc. 1: 25-32.

Tai, J. T., 1924. A preliminary report of cases of Schistosoma japonicum infection. Nat. Med. J. China 10(6): 370-376.

Tajimi, T., 1936. On the prevalence of helminthiasis among the Japanese and Chinese in the district of Shanghai. V. Results of examinations of helminths ova among Japanese kindergarten children and their family members. J.Shanghai Sci.Inst.(Sec.4)2:169-183.

Takei, H., 1941. Species and distribution of Anopheles in Hainan Island. Bull. Naval Med. Ass. Tokyo 30(7): 414-437; (8): 541-555. (In Japanese).

T'an, C. C., 1942. Study on the natural enemies of culicid larvae and their role in mosquito control. Sinensia 13(1-6): 69-88.

_____, 1943. Study on the natural infection of Anopheles hyrcanus var. sinensis with malaria parasite in Pehpei, Szechwan. Sinensia 14(1-6): 141-142.

Tang, C. C., 1936. A survey of helminth fauna of cats in Foochow. Peking Nat. Hist. Bull. 10(3): 223-231.

_____, 1936. Schistosomiasis japonica in Fukien, with special reference to the intermediate host. Chinese Med. J. 50(11): 1585-1590.

_____, 1939. Trichinella infection in rats in Fukien. Chinese Med. J. 55: 537-541.

_____, 1939. Further investigations on schistosomiasis japonica in Futsing, Fukien Province. Chinese Med. J. 56: 462-473.

Tang, C. C., 1940. A comparative study of two types of Paragonimus occurring in Fukien, south China. Chinese Med. J. Suppl. 3: 267-291.

_____, 1941. Notes on trypanosome infection in a donkey in Fukien. Peking Nat. Hist. Bull. 15(4): 297-298.

_____, 1941. Contribution to the knowledge of the helminth fauna of Fukien. Pt. 1. Avian, reptilian and mammalian trematodes. Peking Nat. Hist. Bull. 15(4): 299-316.

Tang, F. F., 1933. A few cases of septicemia. Chinese Med. J. 47(7): 666-673.

_____, and Yang, S. Y., 1933. A study of the meningococci isolated in China. Chinese Med. J. 47(8): 747-757.

T'ang, T. K., 1937. The occurrence of Weil's disease in Canton, China. Chinese Med. J. 51(4): 483-488.

Tang, W. K. and Chang, K., 1943. Symptoms of hookworm disease. Chinese Med.J. 61A(3):105-106.

Tao, C. S., 1935. A study of the smallpox prevalence and inoculation data in some districts of Kiangsu Province. Trans.Ninth Congr.Far East.Ass.Trop.Med.Nanking(1934)2:499-501.

_____, 1936. Transmission of helminths ova by flies. J.Shanghai Sci.Inst.(Sec.4) 2: 109-116.

_____, Yu, T. H., Chu, P. J. and Wang, C., 1935. Study on the prevalence of intestinal parasitic infection among school pupils in Shanghai. Chinese Med. J. 49(6): 570-576.

Tao, S. M., 1930. Giardia intestinalis in north China. A study of 649 cases. Nat. Med. J. China 16(4): 347-359.

_____, 1931. Entamoeba histolytica infection in north China. A study of 1,000 positive cases. Nat. Med. J. China 17(4-5): 412-434.

Taylor, A. G., 1931. Report on examination of stools. China Med. J. 45(8): 790.

Taylor, H. W. Y., 1931. A few facts about the distribution of kala-azar in Manchuria. China Med. J. 45(1): 40-42.

_____, 1935. The incidence of certain tropical diseases in Moukden and the surrounding parts of south Manchuria. Trans.Ninth Congr.Far East.Ass.Trop.Med.Nanking(1934) 2: 403-406.

Tchang, J., Lotsong, S., 1935. Recherches sur le typhus exanthématique dans le nord de la Chine. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 1: 221-248.

Tchang, T. L., 1931. Notes on some Chinese lizards. Bull.Fan Mem.Inst.Biol. 2(14): 265-280.

_____, 1932. Notes on some Chinese snakes. Bull. Fan Mem. Inst. Biol. 3(1): 1-24.

Tei, T. W., 1931. Filariasis in Amoy, China. Taiwan Igakkai Zassi (J. Med. Ass. Formosa) 30(7): 776-781. (In Japanese with English summary).

Tenbroeck, C., Li, C. P. and Yü, H., 1931. Studies on paratyphoid C bacilli isolated in China. J. Exp. Med. 53(3): 307-315.

Tokunaga, M., 1940. Biting midges from Japan and neighboring countries including Micronesian Islands, Manchuria, north China and Mongolia. (Diptera, Ceratopogonidae). Tenthredo 3(1): 58-100; (2): 101-165.

Tootell, G. T., 1924. A preliminary survey of schistosomiasis infection in the region of Changteh. China Med. J. 38(4): 270-274.

_____, 1924. Tartar emetic in schistosomiasis japonica. China Med. J. 38(4): 276-278.

Toumanoff, C., 1934. Observations sur les habitudes trophiques des anophélines de la colonie de Hong Kong. Bull. Soc. Path. Exot. 27(8): 745-749.

_____, 1936. L'anophélisme en Extrême-Orient. Contribution faunistique et biologique. Coll. Soc. Path. Exot. Monograph IV. 434 pp.

_____, Hu, S. M. K., 1934. Premières données sur la zoophilie de A. hyrcanus var. sinensis en Chine (région de Changhaï). Bull. Soc. Path. Exot. 27(7): 741-745.

_____, _____, 1935. Sur le comportement trophique d'Anopheles hyrcanus var. sinensis dans la région de Changhaï. Bull. Soc. Path. Exot. 28(9): 832-835.

_____, Try, H. T., Chang, T. L., 1939. Au sujet de l'existence de Filaria malayi et F. bancrofti dans la haute-région tonkinoise et du rôle probable des diverses espèces culicidiennes dans la transmission de la filariose humaine. Rev. Méd. Franç. d'Extrême-Orient 17(7): 871-876.

Tournier, E., 1928. Remarques sur des cas de choléra observés au camp de l'arsenal de l'est (Chine du nord). Bull. Soc. Path. Exot. 21(4): 295-298.

_____, Guénolé, A., 1928. Épidémie de dengue hivernale en Chine du nord. Bull. Soc. Path. Exot. 21(8): 617-620.

Tsang, M. L., 1925. The importance of venereal clinics, with a report of 400 cases from the St. Luke's Genitourinary Clinic, Shanghai. Nat. Med. J. China 11(3): 172-187.

Tsen, E. T. H., 1920. The prevalence of syphilis in Peking. First report. Nat. Med. J. China 6(3): 159-166.

_____, 1934. Immunization against diphtheria and scarlet fever with combined toxoid. Chinese Med. J. 48(5): 445-448.

Tso, E., 1923. Statistics of communicable diseases among hospital employees. China Med. J. 37(3-4): 226-231.

Tsuchiya, K. and Li, T. C., 1929. On pest epidemic at Chienchiatien, Inner-Mongolia. J. Oriental Med. 10(3): 33-37.

_____, and Nagata, S., 1928. On dysentery in south Manchuria. J. Oriental Med. 8(5): 71-85.

Tucker, E. B., 1937. Missionaries Memorial Hospital, Chaotung, Yunnan, China. (News & Notes). Chinese Med. J. 51(1): 121-123.

T'ung, T. and Chung, H. L., 1938. The Kolmer's, Wassermann, Kahn and Kline tests in relapsing fever. Chinese Med. J. Suppl. 2: 315-324.

_____, and Wong, S. C., 1940. The incidence of tuberculous infection among dairy cattles in Peking. Chinese Med. J. Suppl. 3: 439-445.

_____, and Zia, S. H., 1936. Undulant fever among laboratory workers. Report of three cases with bacteriological study. Chinese Med. J. 50(9): 1203-1210.

Tunnell, N., 1943. Blackwater fever in south Fukien. Two case reports. Chinese Med. J. 61A(4): 169-170.

Turner, W. H., 1931. Typhus fever: Notes. China Med. J. 45(2): 148-150.

Tyau, E. S., 1924. The incidence of skin diseases in Shanghai. Nat.Med.J.China 10(2): 75-79.

Uchino, H. and Okubo, S., 1933. On anaerobic bacilli isolated from cases of gas gangrene during Shanghai hostilities. Bull. Naval Med. Ass. Tokyo 22: 159-173. (In Japanese with English summary).

Urabe, K., 1934. Species and distribution of mice in Mukden and Hwai-te. Studies of animals connected with the carrying of plague. Pt. 1. J. Oriental Med. 21(3): 303-319.

Uttley, K. H., 1938. The Chinese urban death rate in Hong Kong. Trans. Roy. Soc. Trop. Med. Hyg. 31(4): 457-468.

_____, 1938. The epidemic of bubonic plague in Hong Kong. Caduceus 17(1): 1-20.

_____, 1938. Studies in tuberculosis in Hong Kong. J. Hyg. (London) 38(2): 150-179.

_____, 1938. The death rate and epidemiology of smallpox in Hong Kong. Trans. Roy. Soc. Trop. Med. Hyg. 31(6): 635-646.

Villain, G., 1925. Le tokelau (tinea imbricata) dans la province chinoise de Honan. Bull. Soc. Path. Exot. 18(8): 618-622.

_____, 1925. Note sur le kala-azar du Honan (Chine centrale). Bull. Soc. Path. Exot. 18(8): 669-676.

Virnich, A., 1935. Kala-azar bei einem Europäer in China. Arch. Schiffs- u. Trop. Hyg. 39(8): 345-347.

_____, 1937. Über Darmflagellaten in Shanghai. Arch. Schiffs- u. Trop. Hyg. 41(2): 283-295.

Vogel, H., Wu, K. and Watt, J. Y. C., 1935. Preliminary report on the life history of Paragonimus in China. Trans.Ninth Congr.Far East.Ass.Trop.Med.Nanking (1934) 1: 509-517.

Walch, E. W. and Walch-Sorgdrager, G. B., 1935. The eggs of some Netherlands-Indian anophelines. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 2: 65-81.

Wallace, F. G., 1936. A new intermediate host of Fasciolopsis buski (Lankester) (Trematoda: Fasciolidae). Lingnan Sci. J. 15: 125-126.

Wallace, M. E., 1922. Hookworms. China Med. J. 36(1): 71-73.

Wang, C. W., 1937. The examination of blood smears for Leishmania donovani in kala-azar patients. Chinese Med. J. 52: 433-438.

_____, and Lee, C. U., 1938. Neostibosan and experimental kala-azar in Chinese hamsters. I. Normal hamsters. II. Infected hamsters. Proc. Soc. Exp. Biol. Med. 38(5): 670-678.

_____, and T'ung, T., 1936. Bacteremia due to the gravis type of Corynebacterium diphtheriae. Am. J. Dis. Child. 52(4): 899-903.

Wang, L. S., 1938. Human infection of Hymenolepis nana in north China. An analysis of 171 cases. Chinese Med. J. 54(2): 141-150.

Wang, M. Y., Hemenway, R. V. and Lans, S., 1935. Report of nine hundred and sixty cases of malaria in Mintsing, Fukien. Chinese Med. J. 49: 1235.

Wang, S. H. and Hsieh, C. K., 1937. Roentgenologic study of paragonimiasis of lungs. Chinese Med. J. 52(6): 829-842.

Wang, T. Y., Shen, J. Y. and Chang, C. C., 1937. An inquiry into the prevalence of syphilis in Nanking. Chinese Med. J. 51(6): 983-988.

Wang, Y. T., 1924. One case of typhus among the sailors in Tsingtao. Gen. Med. J. China 2(8): 461-462. (In Chinese).

Wassell, C. M., 1922. Epidemic encephalitis. China Med. J. 36(5): 410-417.

_____, 1923. Isospora hominis discovered in China. China Med. J. 37(8): 661-663.

_____, 1924. Fasciolopsiasis endemic in Hupeh. China Med. J. 38(7): 613.

Watson, A. J., 1936. Vincent's disease. Chinese Med. J. 50(1): 46-49.

Watson, P. T., 1919. The epidemic in Shansi: Pneumonic plague or influenza? China Med. J. 33: 169-173.

Watt, J. Y. C., 1936. Study on the bionomics of the intermediate host of Schistosoma japonicum in Kutang, Chekiang, 1934-35. Chinese Med. J. Suppl. 1: 434-441.

_____, 1937. Incidence of helminthic parasites, with special reference to the epidemiology of fasciolopsiasis buski in Shiaoshan, Chekiang, 1934-1935. Chinese Med.J.51(1):77-84.

Whyte, G. D., 1909. Filarial periodicity and its association with eosinophilia. J. Trop. Med. Hyg. 12(12): 175-183.

Wilkinson, P. B., 1938. The influenza epidemic of 1936 in St. Helena. Caduceus 17(2): 95-102.

_____, 1939. Streptocide in the treatment of meningococcal meningitis. Caduceus 18(1): 1-45.

_____, 1939. Epidemic pneumococcal meningitis in Hong Kong. Caduceus 18(2): 95-143.

_____, 1939. Cephalia tetanus. Caduceus 18(3): 211-219.

Williams, L. L., 1941. Malaria of the China Burma highway. Am. J. Trop. Med. 21(1): 1-11.

Williams, T. H., 1938. Human Schistosoma infection in Szechwan. A case report. Chinese Med. J. 54(2): 159-161.

_____, 1940. Echinococcus granulosus in Szechwan. Chinese Med. J. 57(2): 176-178.

_____, 1940. A survey of intestinal parasites in rural Szechwan. Chinese Med. J. 57(5):464-472

Wilson, S. D. and Wang, Y., 1939. Studies on the control of fecal-borne diseases in north China. A preliminary report on the chemistry of feces cakes. Peking Nat. Hist. Bull. 13(4): 269-282.

Winfield, G. F., 1935. On the use of Ascaris lumbricoides as a public health standard in the study of problems of rural sanitation. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 2: 791-797

Winfield, G. F., 1937. Studies on the control of fecal-borne diseases in north China. I. Problems and methods. II. The distribution of Ascaris lumbricoides infestations in a rural population. Chinese Med. J. 51(2): 217-236; (4): 502-518.

_____, and Chin, T. H., 1938-1939. Studies on the control of fecal-borne diseases in north China. VI. The epidemiology of Ascaris lumbricoides in an urban population. VII. The epidemiology of the parasitic amoebae. Chinese Med. J. 54(3): 233-254; 56(3):265-286.

Wong, A. and Wong, D. H., 1933. Bacillus welchii infection in cases of abortion. Chinese Med. J. 47(9): 877-887.

_____, _____, 1935. The causes of the onset of acute dysenteric symptoms in bacillary dysentery carriers. Trans.Ninth Congr.Far East.Ass.Trop.Med.Nanking (1934) 2: 441-449.

Wong, D. H., 1935. Dysentery agglutinins among the Chinese. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 1: 155-161.

_____, 1936. Brucella agglutininsamong the Chinese in Shanghai. Chinese Med.J. Suppl.1:280-287.

_____, and Chow, C. H., 1937. Group agglutinins of Brucella abortus and Vibrio cholerae. Chinese Med. J. 52: 591-594.

Wong, H., Kang, T. and Jarvis, B. W., 1937. Some notes on malaria in Foochow, a review of 107 cases in 1935. Chinese Med. J. 51(3): 385-390.

Wong, K. C., 1930. The early history of leprosy in China. China Med. J. 44(8): 737-743.

_____, and Wu, L. T., 1936. History of Chinese Medicine, Being a Chronicle Happening in China from Ancient Times to the Present Period. 2nd ed. Shanghai. XXVIII & 906 pp.

Woo, T. T., 1940. The incidence of tuberculous infection in a Peiping children's clinic. Chinese Med. J. 58: 671-676.

Woods, A. H., 1922. Types of cerebro-spinal syphilis in China. China Med. J. 36(3): 206-215.

_____, 1924. Epidemic encephalitis. China Med. J. 38(1): 1-11.

Wright, J. M., 1914. Balantidium coli. China Med. J. 28(4): 259-260.

Wu, C. C. and Sun, C. J., 1938. Notes on the study of kala-azar transmission. Pt. 3. Experimental infection of Chinese sandflies of the erect-haired division fed on kala-azar patients and infected Chinese hamsters. Chinese Med. J. Suppl. 2: 579-591.

Wu, C. F., 1940. Catalogus Insectorum Sinensium. Vol.5. Diptera and Siphonaptera. Peiping. 524 pp.

Wu, C. J., 1933. Serological evidence on the European type of typhus fever in China. Proc. Soc. Exp. Biol Med. 30(4): 430-432.

_____, and Chiu, T. Y., 1933. Pneumococcal lobar pneumonia, a clinical study of 242 typed cases. Chinese Med. J. 47(6): 545-559.

_____, and Ma, T. C. C., 1938. Dick reaction and active immunization against scarlet fever with toxoid among school children. Chinese Med. J. 53: 427-438.

_____, and Zia, S. H., 1935. Systemic Salmonella infections in man, clinical and bacteriological study. Chinese Med. J. 49(11): 1217-1227.

_____, _____, 1938. Experimental study of typhus viruses from Peiping and their cross immunity with the mexican strain. Chinese Med. J. Suppl. 2: 221-226.

_____, _____, 1938. Isolation of typhus fever virus from house rats in Peiping. Proc. Soc. Exp. Biol. Med. 39(1): 163-165.

_____, _____, 1939. Isolation of murine typhus Rickettsia from house rats in Peiping. Chinese Med. J. 55: 231-238.

Wu, C. Y., 1935. The occurrence, distribution and seasonal prevalence of rat-fleas in China. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 2: 761-771.

_____, 1936. Rats and rat-fleas of Shanghai. Rep. Nat. Quarantine Serv.Shanghai Ser. 6, 1935-36: 31-41.

Wu, H. T., 1939. A typhoid neoplasm with metastasis simulating neoplasm of the lung. Caduceus 18(4): 273-276.

Wu, H. W. and Hu, Y. T., 1938. Parasitic nematodes from Hainan. Sinensia 9(5-6): 275-297.

Wu, J. P., 1936. Tuberculous meningitis. A study of 200 cases. Chinese Med.J. 50(4):506-519.

_____, 1937. Staphylococcus bacteremia in children. A clinical study of 43 cases. Chinese Med. J. 52: 807-816.

Wu, K., 1930. A study of the common rat and its parasites. Lingnan Sci. J. 9(1-2): 51-64.

_____, 1935. Notes on certain larval stages of the lung fluke, Paragonimus, in China. Chinese Med. J. 49: 741-746.

_____, 1936. Preliminary note on the Paragonimus metacercaria among the crabs at Futsing, Fukien. Proc. Sci. Soc. China (Zool. Sec.) Peiping: 44-45.

_____, 1936. Distribution of paragonimiasis in China. I. Chekiang Province. Chinese Med. J. Suppl. 1: 442-448.

_____, 1939. Deux nouvelles plantes pouvant transmettre le Fasciolopsis buski. Revue générale. Annales Parasit. 17(5): 458-464.

_____, 1937. Helminthic fauna in vertebrates of the Hangchow area. Peking Nat. Hist. Bull. 12(1): 1-8.

_____, 1938. Cattle as reservoir hosts of Schistosoma japonicum in China. Am. J. Hyg. 27(2): 290-297.

_____, 1938. Schistosomiasis in the Shanghai hills region. China J. 28(3): 133-139.

_____, 1939. Paragonimus among leopards and tigers in China. Peking Nat.Hist.Bull.13(4):231-245.

_____, 1941. Snails as carriers of human parasitic disease in China. China J. 34(4):173-183.

_____, and Chen, C. Z., 1941. A preliminary report on the animal helminths from Shanghai abattoirs. Peking Nat. Hist. Bull. 15(3): 217-223.

_____, and Hsu, H. P. H., 1941. Schistosomiasis in China. Nat. Med. J. China 27(8): 480-483; (9): 553-559; (10): 606-613. (In Chinese).

Wu., L. S., 1939. Taenia infection. Report based on stool examinations of 56,286 patients in the Peiping Union Medical College. Chinese Med. J. 55: 561-565.

Wu, L. T., 1917. North Manchurian Plague Prevention Service. Reports 1914-1917. Peking. 133 pp.

_____, 1921. Second pneumonic plague epidemic in Manchuria, 1920-21. Nat. Med. J. China 7(3): 98-121.

Wu, L. T., 1921. North Manchurian Plague Prevention Service. Summary of eighth annual general report, 1920. Nat. Med. J. China 7(4): 240-249.

_____, 1922. North Manchurian Plague Prevention Service. Reports 1918-1922. Tientsin. 314 pp.

_____, 1922. Plague in the Orient with special reference to the Manchurian outbreaks. China Med. J. 36(1): 25-26.

_____, 1926. North Manchurian Plague Prevention Service. Reports 1925-1926. Tientsin. 360 pp.

_____, 1926. A Treatise on Pneumonic Plague. Publ. League of Nations. III.Health. C.H.474. 466 pp.

_____, 1927. The problem of venereal diseases in China. Nat. Med. J. China 13(1): 109-131.

_____, 1929. North Manchurian Plague Prevention Service. Reports 1926-1928. Tientsin. 350 pp.

_____, 1929. Rodents of Manchuria and Mongolia and their significance in disease. Peking Soc. Nat. Hist. Bull. 4(2): 95-102.

_____, 1930. North Manchurian Plague Prevention Service. Reports 1928-1930. Tientsin. 233 pp.

_____, 1932. The cholera epidemic. Chinese Med. J. 46(9): 931-934.

_____, 1933. The present status of the leprosy question in China. Chinese Med.J.47(3):294-296.

_____, 1935. Pestilence and plague in China. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 2: 735-759.

_____, 1936. Report of Central Cholera Bureau in 1935. Rep. Nat. Quarantine Serv. Shanghai Ser. 6, 1935-36: 139-177.

_____, Chun, J. W. H. and Pollitzer, R., 1926. Preliminary report of the cholera epidemic of 1926. Nat. Med. J. China 12(6): 413-452.

_____, _____, _____, and Wu, C. Y., 1934. Cholera: A Manual for the Medical Profession in China. Shanghai. XXII & 197 pp.

_____, _____, _____, _____, 1936. Plague: A Manual for Medical and Public Health Workers. Shanghai. XXXIII & 547 pp.

_____, Pollitzer, R., Lin, C. S. and Jettmar, H. M., 1929. Studies upon the plague situation in north China. Nat. Med. J. China 15(3): 273-402.

Wu, L. Y., 1935. Investigations on natural infections of anopheline mosquitoes with malarial parasites in Canton. Lingnan Sci. J. 14(4): 691-692.

_____, 1936. A survey of anopheline larvae of Kwangtung Province, with notes on their relation to the incidence of malaria. Lingnan Sci. J. 15: 1-10; 265-274.

Wu, W. C., 1927. A case of infantile epidemic encephalitis. Chines. Zeitschr. Ges. Med. 5(2): 82-88. (In Chinese).

Wu, W. H., 1941. Malaria in Menting, Yunnan. Nat. Med. J. China 27(8): 483-490.

Wyatt, H. G., 1929. Attacks of jaundice in Shansi. China Med. J. 43(1): 52-53.

Wylie, J. H., 1920. Cholera in Paotingfu, 1919. China Med. J. 34: 252-253.

_____, 1920. Kala-azar in north China. China Med. J. 34(6): 593-601.

_____, 1930. Typhoid and paratyphoid at Paotingfu. China Med. J. 44(1): 81-91.

_____, 1935. Tubercular infection among Chinese middle school students. Chinese Med. J. 49(6): 553-561.

Yamada, S., 1924. A revision of the adult anopheline mosquitoes of Japan: Systematic descriptions, their habits and their relations to human diseases, together with an account of three new species. Sci. Rep. Govt. Inst. Infect. Dis. 3: 215-241.

_____, 1925. A revision of the adult anopheline mosquitoes of Japan: Systematic descriptions, their habits and their relations to human diseases. Pt. 2. Sci. Rep. Gov. Inst. Infect. Dis. 4: 447-493.

Yang, C. S., 1940. Rat-bite fever in Kweiyang. Chinese Med. J. 58: 245-250.

_____, and Chiang, W. L., 1934. Some notes on malaria in Nanking. Review of 250 cases. Chinese Med. J. 48(2): 124-137.

Yang, F. H., 1935. Zur Kenntnis der Phlebotomen-Arten in China und zur Aetiologie des Phlebotomenfiebers. Trans.Ninth Congr.Far East.Ass.Trop.Med. Nanking (1934) 1:495-502.

Yang, S. S. and Wei, K. H., 1937. Conditions of infectious diseases in Nanking. Public Health Monthly 2(7): 545-553. (In Chinese).

Yang, S. Y., 1938. Bacteriophage in relation to positive stool cultures in typhoid fever. Chinese Med. J. Suppl. 2: 243-246.

Yang, T. K., 1928. Problems of cholera in China and Japan. J. Oriental Med. 9(3): 29-34.

_____, and Shih, W. H., 1924. Scarlet fever in China. Nat. Med. J. China 10(3): 153-170.

Yang, Y. N., 1936. Prevention of plague in Lungyen, Fukien Province. Public Health Monthly 1(10): 21-36. (In Chinese).

_____, Landauer, E., Koo, C. K. and Lin, P. C., 1939. Plague work in Fukien, December 1935 to November 1936. Chinese Med. J. 55: 55-73; 162-173; 262-275; 383-390; 479-487.

_____, and Sung, C. H., 1936. A report of laboratory examinations in a dysentery epidemic in Kiangsi, with special reference to the examination of carriers. Chinese Med. J. Suppl. 1: 275-279.

Yao, H. Y., 1939. Plan for malaria control in Yunnan. Chinese Med. J. 56(1): 63-68.

_____, Yuan, I. C. and Huie, D., 1929. The relation of flies, beverages and well water to gastro-intestinal diseases in Peiping. Nat. Med. J. China 15(4): 410-418.

Yao, Y. C., 1936. Investigation of "changch'i" in the border of Kweichow and Kwangsi. Public Health Monthly 1(8): 33-39. (In Chinese).

Yao, Y. T., 1936. Report on the investigation of schistosomiasis japonica in I-Hsing, Tai Hu endemic area. Chinese Med. J. 50(11): 1667-1669.

_____, 1938. Schistosomiasis in Kwangsi. Chinese Med. J. 54(2): 162.

Yao, Y. T., 1943. Present status of malaria in Free China. Chinese Med.J.(Washington)61(1):38-46

_____, and Chu, H. J., 1935. Intestinal parasites among the people under suburban conditions in Tangshan,Nanking. Trans.Ninth Congr.Far East.Ass.Trop.Med.Nanking(1934) 2:551-553.

_____, Hsu, S. C. and Ling, L. C., 1935. On the occurrence of intestinal parasites in man in different combinations. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 2: 531-538.

_____, _____, _____, 1935. Intestinal parasite infection of primary school schildren in Nanking. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 2: 539-549.

_____, and Ling, L. C., 1935. Epidemiological study of malaria in Nanking. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 2: 89-106.

_____, _____, 1936. Studies of the so-called changch'i. Pt. 1. Changch'i in Kweichow and Kwangsi border. Chinese Med. J. 50(5): 726-738.

_____, _____, 1937. Study of mosquito fauna in southwestern China, especially in the provinces of Kweichow and Yunnan. Japanese J. Exp. Med. 15(2): 121-136.

_____, and Wu, C. C., 1935. One year's observation of A. hyrcanus var. sinensis in Nanking, 1933. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 2: 3-26.

_____, _____, 1938. Notes on a species of Phlebotomus newly found in Tsingkiangpu, north Kiangsu, China. Chinese Med. J. Suppl. 2: 527-537.

_____, _____, 1941. Notes on the Chinese species of genus Phlebotomus. Pt. 3. Sandflies in Nanning, and Tienpao, Kwansi. Pt. 4. Diagnostic tables for the Chinese species of sandflies with some remarks on their geographical distribution. Pt. 5. Some additional records of Phlebotomus from Yunnan Province, south China. Chinese Med. J. 59(1): 67-76; 60(1): 73-78; 79-80.

_____, _____, 1941. On the peculiar morphology of the malaria parasite from a patient and the possibility of its being Plasmodium ovale. Chinese Med. J. 60(2): 178-183.

_____, _____, 1941. The finding of Phlebotomus chinensis Newstead from Yunnan and its bearing on the transmission of kala-azar in south China, with remarks on the success in infecting Chinese hamsters with flagellates from naturally infected P. chinensis found in Tsingkiangpu. Chinese Med. J. 60(3): 232-240.

_____, _____, and Pei, Y. S., 1943. Some epidemiological factors of malaria in Mangshih, Yunnan, with remarks on the occurrence of blackwater fever. Chinese Med. J. (Washington) 61(3): 197-211.

_____, _____, and Sun, C. J., 1938. The development of Wuchereria bancrofti var. mongolensis. A preliminary report. Chinese Med. J. Suppl. 2: 401-410.

Yen, C. H., 1934. Notes on the periodicity of Wuchereria bancrofti Cobbold in Shanghai region. Lingnan Sci. J. 13(4): 607-613.

_____, and Chang, T. L., 1935. The periodicity of Microfilaria malayi Brug as observed from a case in the Lester Chinese Hospital, Shanghai. Lingnan Sci. J. 14(3): 399-402.

Ying, C. Y., 1936. Sanitary work in the factories in the First Health District of Peiping. Public Health Monthly 1(7): 49-64. (In Chinese).

Ying, Y. Y., 1930. Paragonimus infection. A report of two cases. Nat.Med.J.China 16(5):638-642.

_____, 1935. Beri-beri in typhoid fever and its clinical significance. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 2: 415-419.

_____, 1940. The persistence of vibrios in cholera patients, a study of two hundred cases. Chinese Med. J. 58: 595-596.

Yokogawa, S., Morishita, K., 1931-1933. Human Helminthology. 2 vols. Tokyo. Vol. 1, 529 pp., 1931; Vol. 2, 603 pp., 1933. (In Japanese).

Young, C. W., 1923. Kala-azar in China. China Med. J. 37(10): 797-802.

_____, and Hertig, M., 1926. The development of flagellates in Chinese sandflies (Phlebotomus) fed on hamsters infected with Leishmania donovani. Proc. Soc. Exp. Biol. Med. 23(7): 611-615.

_____, _____, 1927. Kala-azar transmission experiments with Chinese sandflies (Phlebotomus). Proc. Soc. Exp. Biol. Med. 24(9): 823-825.

_____, _____, 1929. The kala-azar transmission problem: Field and laboratory studies in China. I. Epidemiology. Am. J. Hyg. 9: 227.

_____, _____, and Liu, P. Y., 1929. The kala-azar transmission problem: Field and laboratory studies in China. II. Susceptibility of various rodents to infection with Leishmania donovani. Am. J. Hyg. 10(1): 183-200.

Young, S. T., 1936. Studies on the final host of Fasciolopsis buski and its development in the intestine of the pig. J. Shanghai Sci. Inst. (Sec. 4) 2: 225-236.

_____, 1939. Kala-azar in Pi-Hsien District, Kiangsu Province, China. II. Findings in films of spleen and liver puncture juice and some other observations in kala-azar. J. Shanghai Sci. Inst. (Sec. 4) 4: 265-272.

Yü, H., 1938. The virulence and immunogenic activities of V. cholerae in the preparation of cholera vaccine. Chinese Med. J. 54(3): 255-258.

_____, and Hu, Y. F., 1939. Studies on the types of Corynebacterium diphtheriae in Shanghai. Chinese Med. J. 56: 456-461.

_____, and Towers, A. E., 1938. Vaccine treatment of diphtheria carriers. Chinese Med. J. 53: 553-558.

_____, and Wei, H., 1935. Studies on local strains of streptococci in scarlet fever. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 1: 185-191.

Yü, K. Y., 1935. Indigenous cases of leprosy in Manchuria. Report of 4 cases. Chinese Med. J. 49(7): 644-651.

_____, and Taylor, H. W. Y., 1931. Notes on leprosy in the three eastern provinces. China Med. J. 45(9): 855-867.

Yu, N. G. and Ying, Y. Y., 1943. Typhus fever as seen in Kunming and Shanghai. Chinese Med. J.(Washington) 61(1): 55-72.

_____, _____, 1943. Notes on subtertian malaria in Yunnan. Chinese Med. J. (Washington) 61(1): 17-30.

Yu, T. H., Chu, P. J., Wang, C. and Tao, C. S., 1935. The prevalence of intestinal parasitic infection among school pupils in Shanghai. Trans. Ninth Congr. Far East. Ass. Trop. Med. Nanking (1934) 2: 555-556.

Yuan, I. C., 1933. Vital statistics of the Peiping Health Station. Peking Nat. Hist. Bull. 7(4): 283-292.

_____, 1940. On the fluctuation of mortality in recent years in the Peiping First Health District. Peking Nat. Hist. Bull. 14(4): 291-299.

_____, Chu, F. T. and Lee, C. U., 1939. The seasonal incidence of kala-azar in infants and its significance in relation to the transmission problem of the disease. Chinese Med. J. 56: 241-264.

Yue, M. K., 1928. The epidemic of cholera in Hinghwa City, Fukien, 1st to 25th September, 1927. China Med. J. 42(3): 151-153.

Yui, E. M. and Paty, Jr., R. M., 1935. A review of 203 malaria cases. Chinese Med. J. 49(11): 1228-1234.

Yung, W. W., 1936. Child health work in Peiping First Health Area, 1925-1935. Chinese Med. J. 50(4): 562-572.

Zau, F. D., 1934. A clinical study of cerebrospinal fever, with special reference to the disease in Shanghai. Chinese Med. J. 48(6): 515-535.

Zia, S. H., 1928. Typhoid fever. A clinical study of 256 cases in Peking. Nat. Med. J. China 14(2): 105-118.

_____, 1930. The occurrence of acute poliomyelitis in north China. Nat. Med. J. China 16(2-3): 135-144.

_____, and Hu, C. H., 1938. Susceptibility of rodents (Myospalax fontanieri) to experimental infection with rickettsiae of Chinese typhus. Proc. Soc. Exp. Biol. Med. 38(1): 26-28.

_____, and Wong, D. H., 1932. Brucella infection in Chinese (undulant fever). Chinese Med. J. 46(3): 243-253.

Zinsser, H., 1937. The Rickettsia diseases. Varieties, epidemiology and geographical distribution. Am. J. Hyg. 25(3): 430-463.

Zo, H., 1934. Studies on Fasciolopsis buski in China. Nippon Gankwagakkai Zasshi (J. Japan Ophth. Soc.) 33(1): 46-59. (In Japanese).

China Handbook, 1937-1943. Compiled by the Chinese Ministry of Information, 1943, New York.

China Medical Missionary Association Research Report for 1911. China Med. J. 26(1): 22.

The Chinese Year Book, 1935-36, 1936-37, 1937, 1938-39, 1940-41. Prepared from official sources by the Council of International Affairs.

Cholera in China, 1929. China Med. J. 44(3): 255. (1930).

The cholera epidemic. Chinese Med. J. 46(9): 931-933. (1932).

Cholera in 1932. Chinese Med. J. 46(12): 1207-1209. (1932).

Central Cholera Bureau, Shanghai. (News and Notes). Chinese Med. J. 52: 289-290. (1937).

Cholera epidemic. Chinese Med. J. 54(3): 288. (1938).

Diphtheria epidemic in Hong Kong. Chinese Med. J. 46: 233. (1932).

Encephalitis epidemica. Chinese Med. J. 53: 495-496. (1938).

Hong Kong. Report of the Director of Medical Services, 1938, 1940.

Hwa-hsien Sanitary Bureau, Shensi Province. Report. Public Health Monthly 1(11): 47-64. (1936). (In Chinese).

Kala-azar in China. China Med. J. 45(2): 146-147. (1931).

Kala-azar on Grand Canal. Kala-azar in Kiangsi Province. Chinese Med. J. 47: 1445. (1933).

Hope and Wilhelmina Hospitals, Kulangsu, Amoy. (Report). China Med. J. 45(7): 692. (1931).

Distribution of leprosy in China. Chinese Med. J. 47(3): 299-300. (1933).

Lepers in Kansu. Chinese Med. J. 50(8): 1131. (1936).

A preliminary survey of the endemicity of malaria in Nanking, Soochow, Hangchow, Wukong and districts along the Yangtze Valley. Wei Sheng Shu, Nanking. (National Health Administration). Chinese Med. J. 46: 719-726. (1932).

Investigation on malaria in Pa-k'ua-chou and San-ch'a-ho, Kiangsu Province. (1935). Malaria Laboratory of the Health Experiment Station. Health Semimonthly 2(2): 1-8. (In Chinese).

The Manchoukuo Year Book, 1941. Tokyo.

Centre of Paragonimus infection. Chinese Med. J. 46(5): 542. (1932).

Report of the First Health District of Peiping. Public Health Monthly 1(5): 69-83.(1935)(In Chinese).

Plague in Shansi and Shensi. Chinese Med. J. 46(4): 429-434. (1932).

Round table discussion on plague. Trans.Ninth Congr.Far East.Ass.Trop.Med.Nanking(1934)2:773-784.(1935).

Report on the investigation of schistosomiasis in Chenkiang, by the Bureau of Health, Department of Interior, China. Health Semimonthly 2(1): 21-31. (1935).

Shanghai Municipal Council, Public Health Department. Annual Report of Commissioner of Public Health, 1907-1938.

Shanghai Medical News. Chinese Med. J. 53: 90-91. (1938). 57: 294. (1940).

Country Hospital, Shanghai. (News and Notes). Chinese Med. J. 54(1): 84. (1938).

Shin Pao Yearbook. 1933, 1935. (In Chinese).

Statistical Abstract of the Republic of China. Compiled and published by the Directorate of Statistics, National Government. 1935 (In Chinese), 1940 (In Chinese and English).

Typhus vaccine in China. Chinese Med. J. 53: 83-87. (1938).

Weigl's vaccine against typhus in Mongolia. Chinese Med. J. 58(2): 257. (1940).

Weihsien, Shantung. Report of American Presbyterian Mission Hospital for 1922-1923. Chinese Med. J. 38(4): 307-308. (1924). Id. for 1924. Ibid. 39(9): 816-817. (1925).

APPENDIX A

TEMPERATURE

AND

RAINFALL

MEAN MONTHLY AND MEAN ANNUAL PRECIPITATION IN INCHES - IN CERTAIN LARGE CITIES IN CHINA

Place	Province	N.Lat.	E.Long.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr.	Period
Nanking	Kiangsu	32°03'	118°48'	1.5	1.8	2.4	3.8	3.1	6.2	7.2	4.4	3.3	1.8	1.6	1.4	38.5	1905-1936
Shanghai	Kiangsu	31°12'	121°26'	1.9	2.3	3.3	3.6	3.7	7.0	5.8	5.6	5.0	2.8	2.0	1.4	44.5	1873-1936
Hangchow	Chekiang	30°16'	120°10'	2.8	3.6	4.6	5.2	5.4	8.9	5.3	7.6	6.4	3.2	2.8	2.3	58.3	1904-1936
Wuhu	Anhwei	31°20'	118°21'	2.0	2.2	3.8	4.9	4.9	7.9	6.1	4.8	3.2	2.8	2.3	1.5	46.3	1880-1936
Hankow	Hupeh	30°35'	114°18'	1.8	2.0	3.6	5.9	6.7	9.1	7.1	4.2	3.0	2.9	1.9	1.2	49.5	1880-1936
Hengyang	Hunan	26°56'	112°25'	2.4	5.1	3.8	7.6	8.5	10.3	2.6	4.3	3.1	2.6	4.3	2.7	57.3	1933-1936
Chungking	Szechwan	29°33'	106°33'	0.7	0.8	1.5	3.9	5.7	7.2	5.4	4.9	5.7	4.3	1.9	0.8	42.9	1891-1936
Chengtu	Szechwan	30°41'	104°12'	0.6	0.7	1.4	2.3	3.9	6.4	10.8	17.2	6.6	2.1	0.8	0.5	53.3	1934-1936
Kunming	Yunnan	25°03'	102°42'	0.2	0.8	0.9	0.9	4.4	8.2	10.3	9.7	6.2	3.0	1.6	0.3	46.9	1929-1936
Lungchow	Kwangsi	22°20'	107°01'	0.8	1.4	1.8	3.1	7.1	8.7	9.2	9.4	5.5	2.5	1.3	1.0	51.8	1896-1936
Canton	Kwangtung	23°06'	112°59'	1.7	2.8	3.6	5.9	10.1	10.7	10.1	9.6	5.3	2.3	1.6	1.4	65.2	1907-1936
Amoy	Fukien	24°25'	118°05'	1.3	2.8	3.7	5.1	6.9	6.8	5.0	6.4	4.3	1.4	1.3	1.3	46.4	1880-1936
Tungyung	Fukien	26°33'	120°30'	0.8	2.3	2.9	3.0	4.2	4.6	2.1	3.2	3.0	1.3	0.9	0.8	29.2	1905-1936
Turnabout	Fukien	25°26'	119°56'	1.6	3.2	4.1	5.0	6.1	7.1	3.8	3.8	3.4	1.7	1.5	1.7	43.0	1885-1936
Peiping	Hopei	39°54'	116°28'	0.2	0.2	0.3	0.6	1.3	3.3	9.8	5.8	2.3	0.7	0.3	0.1	24.8	1841-1936
Chinwangtao	Hopei	39°55'	119°38'	0.1	0.1	0.5	0.7	2.5	2.8	7.2	7.6	3.0	0.7	0.5	0.2	25.8	1908-1936
Chefoo	Shantung	37°33'	121°22'	0.6	0.4	0.6	1.0	1.8	2.3	6.6	6.1	2.5	1.1	1.1	0.8	24.8	1886-1936
Tsingtao	Shantung	36°04'	120°19'	0.4	0.3	0.8	1.2	1.7	3.2	5.6	5.8	3.3	1.4	0.9	0.7	25.4	1898-1936
Sian	Shensi	34°15'	117°10'	0.1	0.3	0.7	1.6	2.1	2.2	3.3	4.1	3.3	2.1	0.6	0.3	20.5	1922-1936
Kaifeng	Honan	34°48'	114°19'	0.5	0.3	0.8	1.0	2.3	1.7	8.5	2.5	2.8	0.5	1.3	0.7	22.9	1934-1936
Mukden	Liaoning	41°48'	123°29'	0.2	0.3	0.7	1.0	2.3	3.5	6.4	6.0	3.1	1.5	0.9	0.4	26.3	1906-1929
Dairen	Liaoning	38°54'	121°38'	0.5	0.3	0.7	1.0	1.7	1.8	6.4	5.1	4.0	1.1	1.0	0.5	24.1	1905-1929
Harbin	Kirin	45°45'	126°38'	0.2	0.2	0.4	0.9	1.7	4.3	5.8	4.2	2.2	1.2	0.4	0.2	21.4	1909-1928
Tsitsihar	Heilung-kiang	47°10'	123°49'	0.1	0.1	0.2	0.4	1.1	2.7	4.0	3.0	1.6	0.4	0.2	0.1	13.9	1909-1928
Kiukiang	Kiangsi	29°45'	116°08'	2.4	3.2	5.5	6.9	6.8	3.7	5.6	4.8	3.5	3.4	2.5	1.8	55.1	1885-1936

FAHRENHEIT
MEAN MONTHLY AND MEAN ANNUAL TEMPERATURES IN ~~CENTIGRADE~~ IN CERTAIN LARGE CITIES

Place	Province	N.Lat.	E.Long.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr.	Period
Nanking	Kiangsu	32°03'	118°48'	35.9	38.6	47.4	57.9	68.5	75.9	81.8	81.5	73.0	62.9	51.0	40.2	59.5	1905-1936
Shanghai	Kiangsu	31°12'	121°28'	37.7	39.3	46.4	56.3	65.6	73.5	80.7	80.6	73.0	63.3	52.3	42.2	59.3	1873-1936
Hangchow	Chekiang	30°16'	120°10'	39.2	41.5	49.4	59.5	68.9	76.4	82.9	82.4	74.8	63.8	53.7	44.6	61.5	1919-1936
Wuhu	Anhwei	31°20'	118°21'	36.1	39.7	48.7	59.1	70.1	77.0	83.1	83.4	74.8	64.0	52.7	41.3	60.8	1924-1936
Kiukiang	Kiangsi	29°45'	116°08'	37.9	41.9	50.9	61.3	72.1	78.8	85.4	85.2	76.4	65.3	54.3	43.5	62.7	1924-1936
Hankow	Hupeh	30°35'	114°18'	31.0	41.7	50.9	61.5	71.7	78.6	83.8	83.8	75.3	65.3	53.9	42.8	62.4	1906-1936
Hengyang	Hunan	26°56'	112°25'	38.4	44.4	52.3	61.8	73.5	79.1	85.2	84.7	78.0	66.2	55.9	45.5	63.8	1932-1936
Chungking	Szechwan	29°33'	106°33'	46.0	49.4	57.5	66.0	72.8	77.1	83.8	84.5	75.3	66.0	57.7	50.3	65.6	1924-1936
Chengtu	Szechwan	30°41'	104°12'	39.5	47.8	53.7	62.6	70.8	76.6	80.0	79.1	72.3	62.9	53.6	45.6	62.0	1932-1936
Kunming	Yunnan	25°08'	102°42'	48.5	51.6	57.5	63.5	66.7	66.9	68.0	67.8	82.5	60.4	54.8	49.8	60.0	1929-1936
Lungchow	Kwangsi	22°20'	107°01'	57.7	59.5	65.6	73.7	82.0	83.6	84.2	84.0	82.0	74.8	69.0	62.7	73.2	1924-1936
Canton	Kwangtung	23°06'	112°59'	57.6	57.0	62.7	70.8	79.1	81.8	83.4	83.8	81.6	74.8	68.0	60.9	71.6	1924-1936
Amoy	Fukien	24°25'	118°05'	56.8	55.7	59.7	66.3	75.3	80.4	84.2	84.3	82.4	76.2	68.9	62.2	71.0	1924-1936
Tungyung	Fukien	26°33'	120°30'	49.1	47.4	51.4	58.8	67.6	74.8	80.4	80.9	77.5	70.1	62.9	54.8	64.5	1924-1936
Turnabout	Fukien	25°26'	119°56'	49.2	49.2	52.7	60.2	69.0	76.1	80.7	80.9	60.2	71.4	64.5	57.0	66.0	1924-1936
Peiping	Hopei	39°54'	116°28'	23.7	29.3	41.	56.4	68.1	75.9	78.9	76.8	68.1	54.8	39.0	27.3	53.2	1841-1936
Chingwangtao	Hopei	39°55'	119°38'	20.6	24.4	37.3	48.7	60.8	69.2	75.9	75.9	67.8	54.8	39.2	25.7	49.8	1924-1935
Cheefoo	Shantung	37°33'	121°22'	28.4	30.3	39.2	52.5	64.0	72.3	77.9	77.9	70.8	59.7	46.5	34.1	54.5	1924-1936
Tsingtao	Shantung	36°04'	120°19'	29.4	32.	39.5	50.0	59.9	67.6	74.4	77.1	70.3	60.4	47.1	34.3	53.6	1900-1936
Kaifeng	Honan	34°48'	114°19'	29.4	35.7	46.2	58.1	69.9	78.8	82.4	78.6	70.8	60.2	47.4	36.1	57.9	1932-1936
Sian	Shensi	34°15'	117°10'	30.6	36.1	47.4	58.2	69.0	79.7	82.5	76.8	69.4	58.1	45.1	34.2	57.3	1922-1936
Mukden	Liaoning	41°48'	123°23'	5.	15.4	33.8	47.4	60.4	71.0	76.4	74.4	62.0	48.2	29.8	13.6	44.7	1906-1929
Dairen	Liaoming	38°54'	121°38'	23.	25.7	35.4	48.7	59.3	68.5	74.3	76.2	67.6	56.4	41.3	28.0	50.3	1905-1929
Harbin	Kirin	45°45'	126°38'	-4.7	3.7	20.3	42.2	56.8	67.4	73.7	70.8	57.5	41.5	19.0	.68	37.4	1909-1928
Tsitsihar	Heilung-kiang	47°10'	123°49'	-5.4	4.2	19.7	41.0	56.1	67.8	73.7	70.7	56.8	39.9	16.5	-.4	36.6	1909-1928

APPENDIX B

NOTES ON THE CHINESE ANOPHELINE MOSQUITOES

The following notes are based primarily on the monograph of Feng (1938) with additions derived from subsequent publications and the examination of specimens in the U. S. National Museum. The nomenclature is largely that of Edwards (1932). The collecting localities are those accepted by Feng (1938) in addition to those given in more recent publications as well as those for the Chinese anopheline mosquitoes in the U. S. National Museum. The synonymy is restricted to those names which have been applied in China or to material collected therein.

1. Anopheles (Anopheles) aitkenii James, 1903.

Localities: CHEKIANG - Hangchow.
HUNAN - No localities given (Chang, 1938).
KIANGSI - Kiukiang (Kuling Hill).
KWANGTUNG - Hongkong (as bengalensis Puri, 1930), Hainan Island.
YUNNAN - Tachoutang, Mangshih, Paoshan, Lungling, Yuenkiang; also (as bengalensis) Ch'ehli, Yuenkiang, Szemao.

Distribution: India, Burma, Greater Soenda, Lesser Soenda, Malaya, Philippines, China, Indochina, Thailand, Formosa.

This species is relatively uncommon in China where, as elsewhere, it is unanimously regarded as of no importance in the transmission of disease. Consequently, little has been recorded concerning its biology in China. It seems to prefer to breed in shaded cool and clear-water pools with sandy or stony bottoms. The females have never been observed to attach man.

There is some doubt concerning the taxonomic status of Chinese material. Feng (1938) reports it only as aitkenii whereas Jackson's (1938) records from Hongkong as well as some of the Yunnan records are given as bengalensis. The type locality of aitkenii is Karwar, Bombay Presidency, India; that of bengalensis is Marianbarie, Bengal Terai, India. In general it seems to be agreed that the Chinese form is probably bengalensis although it is obvious that further studies are needed.

2. Anopheles (Anopheles) barbirostris barbirostris van der Wulp, 1884.

Localities: CHEKIANG - Shaohyling.
KWANGTUNG - Canton, Hainan Island.
YUNNAN - Hokéon, Ch'ehli, Szemao, Mangshih, Monkar, Hokow.

Distribution: India, Ceylon, Burma, Malaya, Thailand, Indochina, Greater Soenda, Lesser Soenda, New Guinea, Philippines, China.

This species is likewise uncommon in China and is not considered to be of importance in the transmission of disease in that country. French investigators in Indochina have reached similar conclusions. However, on the island of Celebes it has been found to be an important intermediate host of Wuchereria malayi; on Kabaena Island, near Celebes, it was found to serve as an intermediate host of Wuchereria bancrofti. Anopheles barbirostris has been found naturally infected with malaria plasmodia in Sumatra (0.5 percent), Celebes (2 - 15 percent), Malaya (2.0 percent), and Bangka (5.0 percent). Dissections in most areas have given negative results, however.

The breeding habits of this species are similar to those of Anopheles hyrcanus sinensis; the larvae are found in ponds, pools, rice fields, etc., with vegetation. The adults are apparently primarily zoophilic although they are known to feed on human blood also.

3. Anopheles (Anopheles) gigas baileyi Edwards, 1929.

Localities: SZECHWAN - Golden Buddha Mt., north of Chungking.
TIBET - Yatung.
KWEICHOW - Kweiyang.
YUNNAN - Kochiu, Mokiang, Ch'ehli, Fuhai, Kunming, Ipinglong, Yuanyungching, Yungping, Paoshan, Lungling, Chachia, Hweitseh, Monkar, Mangshih.

Distribution: Tibet, Assam, Bengal, Upper Burma, Formosa, China.

This subspecies is a comparatively wild form with no known role in the transmission of disease. It is apparently completely zoophilic. It breeds chiefly in cool-water pools in mountainous regions above 2,500 feet.

4. Anopheles (Anopheles) gigas simlensis James, 1911.

Localities: TIBET - Chumbi Valley, 10,000 feet.
KWEICHOW - Kweiyang.

Distribution: Western Himalayas.

Fragmentary observations indicate that the biology of this subspecies is similar to that of baileyi. It is apparently of no medical importance.

5. Anopheles (Anopheles) hyrcanus sinensis Wiedemann, 1828.

Anopheles sinensis Wiedemann, 1828.
Myzorhynchus sinensis (Wiedemann), 1828.
Myzorhynchus vanus Walker, of Theobald, 1907.
Anopheles pictus Loew, of Thin, 1900.
Anopheles hyrcanus Pallas, of various authors.
Anopheles sinensis (? var. pattoni) of Pearson, 1935.
Anopheles sinensis vanus (Walker), of Marlett, 1902.
Anopheles hyrcanus var. sinensis Wiedemann, of many authors.

Localities: ANHWEI - Hwangshan.
CHEKIANG - Chienteh, Chinhwa, Chuchi, Fuyang, Haimen, Haining, Hangchow, Hsiaoshan, Huchow, Hwangyen, Iwu, Kashing, Lanchi, Pingyang, Shaohsing (Shaohyling ?), Tienmushan, Tientaishan, Tinghai, Tunglu, Mokanshan (Wuk'ang), Yentangshan.
FUKIEN - Amoy, Changchow, Foochow, Mintsing, Yenpingfu.
HEILUNGKIANG - Between Lahasusu and Gadikaudza in lower Sungari region.
HOPEI - Peiping, Tientsin
HUNAN - Peishihtu, Shaoyang, P'ingkiang, Sunkai; also numerous localities in Hunan-Kwangtung border region.
HUPEH - Wuch'ang, Wuhan area.
KIANGSI - Kiukiang.
KIANGSU - Hsüchowfu, Tsingkiangpu, Nanking, Shanghai, Soochow, Wusih.
KIRIN - Changchun, Kirin.
KWANGSI - Enyang, Hoch'i, Yining, Yishan, Liuchow, Lungsheng, Nanning, Nantan, Peisei, P'ingloh, P'inyang, Sanmenao, Szeloh, Wuchow, Shihlung.
KWANGTUNG - Canton, Hainan Island (many localities), Hongkong (several localities), Pingshih to Lokcheon, Swatow.
KWEICHOW - Kweiyang, Anlung, Shingyi.
LIAONING - Hailung, Mukden.
SHANSI - Fenyang.
SHANTUNG - Chufu, Linchü, T'aian, Tsinan, Tsingtao.
SZECHWAN - Ch'engtu, Chungking, Suifu, Kiating, Mt. Omei, Yachow, Lutinghsien, Kwanhsien, Hanchow, Chengtu, Mienchu, Junghsien.

YUNNAN - Kunming, Ipinglong, Yuanyungching, Chuyung, Hsiakwan, Yungping, Paoshan, Lungling, Mangshih, Chefang, Chachia, Hweitseh, Monkar, Chuchi, Hokéon, Kaiyuen, Lahati, Mashan, Mongtseu, Mannau, San-pe-hou, Tche-t'souen, Ch'ehli, Ch'inglungch'ang, Fuhai, Mengban, Menghwen, Mokiang, Ningerh, Szemao, Yangwupa, Yuenkiang, Loping, Kochiu, Osan, Shinping, Tehetsouen, P'o-chiao, Wen-sing-ko.

Distribution: Northeastern India, Burma, Malaya, Thailand, French Indochina, Greater Soenda (?), China, Chosen, Formosa, Japan.

Anopheles hyrcanus sinensis is the commonest species of anopheline mosquitoes in China. The larvae of this species are to be found in almost any collection of ground water and occasionally even in artificial containers. Larvae have been found in ponds, rice fields, pools, marshes, ditches, slowly flowing streams, borrow pits, drains, etc. It seems to favor open water although this is by no means a rule. Usually the breeding habitats contain much aquatic vegetation. It has been recorded from brackish water but such records are exceptional. Similarly, it is predominately a clean-water breeder although in Burma it has been recorded from foul water.

Voluminous observations have been made on the habits of the adults. The data indicate a considerable variation in biting habits, blood preferences, daytime resting places, and other aspects of behavior. Whether these variations are due to variations in ecology, including available numbers of large mammals other than man, or to physiological races within the subspecies cannot be stated at this time. There is disagreement on its feeding habits. In some areas it appears to be strongly zoophilic, rarely attacking man; in other areas relatively large percentages of the engorged females are found to contain human blood. Toumanoff (1936) described it as both anthropophilic and zoophilic in Hongkong; similar results were obtained by Toumanoff and Hu (1935) in Shanghai. Yao and Wu (1935) described it as primarily zoophilic at Nanking; similar results were recorded by Mesnard and Toumanoff (1935) in Cochinchina and by Hu and Yu (1936) in Shanghai. The latter authors found that even those collected in bedrooms had little inclination to bite humans when livestock were available. Ling and Yang (1937) also regard it as primarily zoophilic. The situation is perhaps best summarized by Feng (1938): "Adult females freely attack man as well as animals such as cattle. In some places they seem to prefer the blood of cattle or other animals. It may be that there are different races with different feeding habits, but thus far investigations on this question are lacking."

Likewise, there is considerable difference in the indicated role in malaria transmission in various parts of China. That it is potentially an effective malaria transmitter is well established by experimental-infection experiments. However, many investigations of natural infection have given negative results whereas those in which infected specimens were found showed marked differences in rate. These variations in natural-infection rates (Table6) are correlated with the local biting habits of the species as well as with the gametocyte index of the population. Wherever hyrcanus sinensis occurs in appreciable numbers and has anthropophilic feeding habits, it must be regarded as a malaria vector. Feng (1938) in considering the available information described it as an important malaria carrier in the plains throughout China. In many endemic localities in China, especially on the plains of central and northern China, it is the only anopheline mosquito present. The same author (1937) regarded it as perhaps a vector in northern Manchuria and Mongolia, doubtless the vector on the north China plains from southern Manchuria to southern Shantung, and definitely the vector in the south China plains. Its role in the hill country is problematical.

The role of hyrcanus sinensis as a vector of filariasis is well established. It has been shown to develop infective larvae of Wuchereria bancrofti in China (Feng 193~~0,~~ 1935~~;~~ ~~1936~~; Hu 1939; ~~1941;~~ Jackson 1936) as well as in Indochina. It is also regarded as an intermediate host of Wuchereria malayi in southern China (Feng 1935), a role well established by investigations in the Netherlands Indies and French Indochina.

Morphologically hyrcanus sinensis is variable in China as in other parts of its range. However, as yet it has not been possible through ecologic or geographic correlation to show agreement between the morphologic and the biological variations. Nevertheless, it seems highly probable that subsequent investigations will bring about the recognition of further subspecies. Walch and Walch-Sorgdrager (1935) believed that two distinct races, based on egg types, existed in Nanking; one had a narrow dorsal surface, the other, a wide broad surface. Baisas and Hu (1936) regarded

the broad-decked type, the only type they found in Chinese material, as sinensis; and the narrow-decked type as including Anopheles hyrcanus lesteri Baisas and Hu 1936 as well as Anopheles hyrcanus nigerrimus.

6. Anopheles (Anopheles) koreicus Yamada and Watanabe, 1918.

This species has been recorded by Feng (1938) from Mokanshan of Wuk'ang in Chekiang Province. Larvae have been found in a cool spring water pool at this locality. No adults have been captured in nature. Besides this record in China, this species has also been recorded in Japan and Chosen. It has no known role in disease transmission.

7. Anopheles (Anopheles) labranchiae atroparvus van Thiel, 1927.

Anopheles (A.) maculipennis Meigen, of Feng, 1938.

Localities: HEILUNGKIANG - Heiho, Lungchen.

Feng (1938) on the basis of the examination of the terminalia of a single male specimen from Heiho determined the Chinese maculipennis-complex form as atroparvus. Reliable records place the range of atroparvus (type locality, Bolsward, Netherlands) no further west than eastern European Russia. Feng's determination is therefore accepted provisionally. It seems possible that the north-China form may be either messeae which has been recorded in central Asia by Russian investigators or an undescribed race. Also to be considered are Anopheles lewisi Ludlow, Anopheles selengensis Ludlow, and possibly Anopheles maculipennis occidentalis Dyar and Knab. Feng (1938) states that the larvae are found in ditches containing fresh water; adults have been captured within human dwellings. Females have been observed to bite cattle but probably bite man also. The role of this species in malaria transmission in China is not known although there is epidemiologic evidence indicating it to be a vector.

8. Anopheles (Anopheles) lindesaii japonicus Yamada, 1918.

Anopheles pleccau Koidzumi, 1923.
Anopheles lindesaii var. pleccau Koidzumi, of Crook, 1939.

Localities: ANHWEI - Hwangshan.
CHEKIANG - Chinhwa, Hangchow, Hwangyen, Lanchi, Mokanshan (Wuk'ang), Tienmushan, Tientaishan, Yentangshan.
FUKIEN - Kushan (Foochow).
HOPEI - Peiping (Western Hills).
KIANGSI - Kiukiang (Kuling Hill).
KWANGSI - Sanmenao.
KWEICHOW - Kweiyang.
SHANTUNG - Huangsiho (T'aian), Laoshan (Tsingtao), T'aishan.
SZECHWAN - Mt. Omei, Whang Ni Puh, Kwanhsien.
YUNNAN - Yünnanfu (Kunming), Mokiang, Mangshih, Ipinglong, Yuanyungching, Hsiakwan, Yungping, Paoshan, Lungling, Chachia, Monkar.

Distribution: Japan, Formosa (?), China.

The larvae of this mountain species are found in cool spring water or shaded pools at high altitudes. In Hopei Province they have been observed to pass the winter under the ice. The adult females are known to attack man although their feeding habits have not been adequately observed. Feng (1938) has pointed out that it is not certain whether or not all of the Chinese lindesaii material is referable to japonicus. In connection with this point, it is interesting to note that Morishita (1936) believes that the Formosan form is typical lindesaii. A single male specimen in the collection of the U. S. National Museum from Hangchow is obviously japonicus. Although this is no evidence to implicate japonicus as a malaria vector in China, it has been suggested to

be a weak vector in Japan. Crook (1939) concluded that in spite of experimental infectibility it is of no consequence as a vector in Szechwan Province.

9. Anopheles (Anopheles) nigerrimus Giles, 1900.

Anopheles hyrcanus var. nigerrimus Giles, of many authors.

Localities: KWANGTUNG - Hainan Island.
YUNNAN - Mengban, Ningerh, Szemao, Yuenkiang, Monkar, Mangshih.

Distribution: India, Ceylon, Burma, Thailand, French Indochina, China, Malaya, Greater Soenda, Philippines.

This species has been elevated from its previously varietal or subspecific status in hyrcanus to a distinct species. This is done not only because of its distinct morphology but also because it coexists with hyrcanus sinensis in many areas.

The larvae have been found in rice fields, ponds, ditches, pools, and other natural collections of water, frequently associated with hyrcanus sinensis. In China the adults have never been found in human dwellings although elsewhere it has been found to attack man occasionally. This species is of no known medical importance.

10. Anopheles (Anopheles) sacharovi Favr, 1903.

Localities: SINKIANG - Kashgar.

Distribution: Southeastern Europe, central Russia, Transcaucasus, Iran, Iraq, Sinkiang Province.

Feng (1938) cites the record of Chtcherbankoff (Les Maladies Tropicales a Kachgar, Chine, Ouest. Rev. med. et Hyg. Trop., 22: 233-256, 1930) as the basis for the occurrence of this species in China. This record is substantiated by the reports of sacharovi from Kazakhstan and Kirgiz by Montschadsky (1936) and Stackleberg (1937). It is therefore included provisionally in this list. There are no recorded observations on the habits of either adults or larvae in China. Because it is the only anopheline mosquito recorded from Sinkiang Province, it is assumed to be the vector of malaria in that province.

11. Anopheles (Anopheles) sineroides Yamada, 1924.

Localities: CHEKIANG - Mokanshan (Wuk'ang).

Distribution: Japan, Chekiang Province in China.

The larvae of this species are found in cold spring pools. No adults have been found in China. In Japan, Yamada (1924) has observed the females to suck human blood under experimental conditions. He also found that partial development of Wuchereria bancrofti occurs in this species. It has no role in malaria transmission.

12. Anopheles (Anopheles) sintonoides Ho, 1938.

This is a tree-hole breeding species which thus far has been recorded only from Hainan Island. Nothing is known about the habits of the adults and their role in disease transmission, if any.

13. Anopheles (Myzomyia) aconitus Dönitz, 1902.

Localities: KWANGTUNG - Hainan Island (several localities).

Distribution: India, Ceylon, Burma, Thailand, French Indochina, Malaya, Greater Soenda.

This species has been reported only from Hainan Island by Takei (1941). However, it is not improbable that it will be found eventually on the mainland since it is a fairly common mosquito in French Indochina. Larvae of this species are found in irrigation ditches, swamps, ponds, rice fields, pools in creeks and river beds, and similar habitats. The adults are anthropophilic and important transmitters of malaria in countries where the species is sufficiently numerous. No information is available on its bionomics or medical importance on Hainan Island.

14. Anopheles (Myzomyia) annularis van der Wulp, 1884.

Anopheles fuliginosus, Giles, 1900.
Anopheles annularis var. adiei James and Liston, 1911.

Localities: KWANGSI - Peisei, Enyang, Shihlung.
YUNNAN - Szemao, Kochiu, Shinping, Yuenkiang, Ningerh, Mangshih, Chefang.
KWANGTUNG - Hainan (numerous localities)

Distribution: India, Ceylon, Burma, Thailand, Malaya, French Indochina, Greater Soenda, Lesser Soenda, Philippines, Formosa.

The larvae of this species have been observed in a variety of habitats including seepage water from hillsides, ponds, pools, rice fields, etc. In general a large area of water with rooted aquatic vegetation seems to be preferred.

The adults are apparently anthropophilic. Feng (1938) describes frequent attacks by this species along rivers in Kwangsi Province. This species probably plays no important role in malaria transmission in China. Robertson (1940) and Chang (1941) found natural indices of infection of 1.5 percent in Yunnan Province. Because of the presence of Anopheles minimus, a very efficient vector, in the same region the role of annularis is difficult to ascertain.

15. Anopheles (Myzomyia) culicifacies Giles, 1901.

Localities: YUNNAN - Kaiyuen, Lahati, Mongtseu, Yünnanfu (Kunming), Mangshih.

Distribution: India, Burma, Ceylon, Siam, French Indochina, southern China.

This species is known only from Yunnan Province; it occurs only on the high plateaus where, according to Yao and Ling (1938), it breeds in pools. Gaschen (1934) also found larvae in streams and pools. The females are anthropophilic attacking man at night. Natural infections have been found in Yunnan Province by Gaschen (1935). Chang (1941) reported a natural infection index of 3.8 percent at Mangshih. In Burma and India culicifacies is a malaria vector of primary importance.

16. Anopheles (Myzomyia) fluviatilis James, 1902.

This species has been recorded only from Hongkong. Since the identification was by Edwards, it is regarded as reliable. Its breeding habits are similar to those of Anopheles minimus, the larvae being found in slowly flowing streams and pools in the stream beds with sandy bottoms. The adults are known to attack man. This species is much less common than the closely related Anopheles minimus. Although there are records of natural infection in India, it seems safe to conclude that this species has no role in malaria transmission in China.

17. Anopheles (Myzomyia) jamesii Theobald, 1901.

Localities: KWANGTUNG - Hainan Island, Hongkong.
YUNNAN - Mangshih.

Distribution: India, Ceylon, Burma, Yunnan, Tonkin, French Indochina, southern China.

In Yunnan Province, Chang (1941) found the larvae of this species twice, once in a lilly pond and once in a pool filled with rain water. Its breeding habitat on Hainan Island has not been observed. Christophers (1933) records larvae from lakes, rain pools, and ponds with grass as well as pools in river beds, springs, and surface wells. Only a single adult has been taken in China (Hainan Island, Riley 1932). Elsewhere adults have been taken in stables and houses. There is no evidence that this species, anywhere in its range, is of any importance in disease transmission.

18. Anopheles (Myzomyia) jeyporiensis candidiensis Koidzumi, 1924.

Localities: CHEKIANG - Yentangshan.
FUKIEN - Amoy, Mintsing.
KWANGSI - Lungsheng, Enyang.
KWANGTUNG - Hainan Island, Hongkong, Loch'ang, Pingshih, Canton.
YUNNAN - Hokéon, Kaiyuen, Lahati, Szemao, Lungling, Mangshih, Chefang, Monkar.

Distribution: India, Burma, China, Formosa, French Indochina.

This is an important malaria vector in southern China including the coastal provinces of Fukien, Kwangsi, and Kwangtung. Larvae are found most frequently in grassy shallow waters such as seepage water from hillsides, abandoned rice fields, and among the stubble of rice fields at the foothills.

The females are strongly anthropophilic although they will also attack domestic animals. Numerous surveys in China have natural-infection indices as high as 10 percent during epidemic periods. In view of these indices and the prevalence of the species in southern China, this species must be regarded as an important vector especially in the hilly regions of the southern provinces. Furthermore, Jackson (1936) has presented evidence indicating that candidiensis is a vector of Wuchereria bancrofti.

19. Anopheles (Myzomyia) karwari James, 1903.

Localities: KWANGSI - Shihlung.
KWANGTUNG - Hainan Island (numerous localities), Hongkong.
YUNNAN - Szemao, Ch'ehli, Fuhai, Lungling, Mangshih.

Distribution: India, Ceylon, Burma, Thailand, French Indochina, Malaya, Greater Soenda, Philippines.

This is a rare species in China being confined to the southernmost provinces. According to Yao and Ling (1937), the larvae have been found in slowly flowing streams and also in ponds and pools. In general it is a species of hilly country breeding on water collected over a rocky or sandy bed. There is no information on its biting habits in China; Toumanoff (1936) has found it to be almost completely zoophilic in French Indochina. Although single natural infections have been found once in India and twice in Malaya, this species is assuredly of no consequence in the transmission of malaria.

20. Anopheles (Myzomyia) kochi Dönitz, 1901.

Localities: KWANGSI - Peisei, Wuchow.
KWANGTUNG - Canton, Hainan Island (many localities).
YUNNAN - Mokiang, Monkar, Mangshih, Hokéon, Hokow.

Distribution: India, Burma, Malaya, Greater Soenda, Moluccas, Philippines, French Indochina, China.

This is a rare, wild species in China. Larvae are found in rice fields, especially those flooded with rain water, in muddy rain water, and pools. Adults have not been found near human habitations. It is of no medical importance.

21. Anopheles (Myzomyia) leucosphyrus Dönitz, 1901.

Localities: KWANGTUNG - Hainan Island (several localities).

Distribution: India, Ceylon, Burma, Malaya, Indochina, Greater Soenda, Philippine Islands, Hainan Island.

Yao (1943) includes leucosphyrus in his list without citing records. Takei (1941) lists it from several localities on Hainan Island although he considered the Hainan form to be a variety and not the typical form. This is essentially a wild jungle species and although occasional natural infections have been found, it is considered to have no importance in the transmission of malaria.

22. Anopheles (Myzomyia) maculatus maculatus Theobald, 1901.

Nyssorhynchus maculatus (Theobald), 1901.
Anopheles maculatus hanabusai Yamada, of Ho, 1938.

Localities: FUKIEN - Amoy.
KIANGSI - Kiukiang.
KIANGSU - Soochow (?).
KWANGSI - Lungsheng, P'ingloh, P'inyang, Peisei, Wuchow, Shihlung.
KWANGTUNG - Canton, Lohkongtung (east of Canton), Hongkong, Kowloon, Swatow, Hainan Island (many localities).
KWEICHOW - Kweiyang.
YUNNAN - Hokéon, Lahati, Mohoangpo, Pechai, Tachoutang, Mengban, Mokiang, Fuhai, Ipinglong, Yuanyungching, Chuyung, Hsiakwan, Yungping, Paoshan, Lungling, Mangshih, Chefang, Chachia, Hweitseh, Monkar.

Distribution: India, Ceylon, Burma, Thailand, Malaya, French Indochina, Greater Soenda, Lesser Soenda, Formosa, Philippines, southern China.

This species occurs characteristically in hilly and mountainous country where the larvae are found in small streams, pools connected with streams, or in river beds. Shady streams with sandy or rocky bottoms are preferred.

The feeding habits of the females are a matter of some disagreement. For example, Toumanoff's first studies (1934) led him to describe it as anthropophilic whereas his later investigations in Hongkong (1936) indicated that it was zoophilic. Information on its occurrence in houses is likewise conflicting. However, it seems probable that it enters houses readily but leaves immediately after feeding. In India it is regarded as anthropophilic.

Anopheles maculatus is to be regarded as a vector of malaria, potential or actual, wherever it occurs. It is especially important in cleared areas in hilly or mountainous regions. Although negative indices are sometimes obtained, many surveys show indices of infection sufficiently high to indicate a malaria-transmitting role. In Hongkong indices varying from 0 to 3.5 percent have been found by Jackson (1936). Chang (1941) and Robertson (1940) recorded natural infection indices of 3.0 percent and 7.1 percent respectively in Yunnan Province. Similar results have been obtained in Malaya, French Indochina, and the Netherlands Indies.

In this list Edwards' (1932) synonymy of maculatus Theobald and hanabusai Yamada is accepted. However, in view of Ho's (1938) use of hanabusai for his Hainan material, this synonymy is perhaps in need of reexamination. Unfortunately, no specimens are available for study at this time.

23. Anopheles (Myzomyia) minimus minimus Theobald, 1901.

Anopheles minimus Theobald, of many authors.

Localities: CHEKIANG - Chienteh, Chinhwa, Fuyang, Hangchow, Tienmushan, Tunglu, Yentangshan.
FUKIEN - Amoy, Changchow, Mintsing.
KIANGSI - Kiukiang.
KWANGSI - Liuchow, Lungsheng, Nantan, P'ingloh, P'inyang, Enyang, Sanmenao, Wuchow, Yining.
KWANGTUNG - Hainan Island (numerous localities), Hongkong (numerous localities), Swatow, Peiyunshan (Canton), Lohkongtung (east of Canton), Loch'ang, Pingshih.
SZECHWAN - Suifu, Kiating, Mt. Omei, Hanchow, Yachow, Mienchu, Chungking.
YUNNAN - Hokéon, Kaiyuen, Lahati, Mahoangpo, Ningerh, Szemao, Kochiu, Lungling, Mangshih, Chefang, Monkar, Hokow.

Distribution: India, Ceylon, Burma, Thailand, French Indochina, southern China, Formosa, Greater Soenda (?), Lesser Soenda.

This species is also a stream breeder although the larvae occur more characteristically in the slowly running hill streams with cool water. They also are found in ditches especially those with grassy edges. Irrigation ditches diverting water from hill country streams are often swarming with the larvae of minimus. Occasionally they may be found in pools of rain water, especially those with sandy bottoms, and elsewhere.

The adults are anthropophilic and attack man freely at night. In localities with abundant breeding habitats, adults are found indoors in great numbers. This species is the most important malaria vector in China and shows higher indices of natural infection than any other Chinese species. It should be regarded as dangerous even in areas where it occurs in relatively small numbers. It is most important in the hilly regions of southern China. Natural infection indices as high as 30 percent (in an epidemic at Amoy, Feng, 1932) are recorded although in endemic areas the rates fluctuate from one percent to twelve percent. It is only rarely that no infected specimens are found in any appreciable number of dissections. Jackson (1935, 1936) and Toumanoff (1939) have observed infective larvae of Wuchereria bancrofti in minimus and feel that it is therefore a vector of filariasis.

24. Anopheles (Myzomyia) pattoni Christophers, 1926.

Localities: HOPEI - Chinhwangtao, Choukoutien, Peiping (Yenching University and Western Hills).
SHANTUNG - Chüfu, Linchü, T'aian, Tsinan, Tsingtao.
SZECHWAN - Ch'engtu, Kwanhsien, Mt. Omei, Yachow, Hanchow, Mienchu, Kiating.

Distribution: China, north of 30°.

The larvae of this species are found chiefly in slowly running hill country streams, rain water pools, and pools in river beds with sandy bottoms. The larvae have been found under the ice and the species is assumed to be able to pass the winter in this manner. The adults are apparently zoophilic as well as anthropophilic. Hindle and Feng (1929) have shown it to be a good experimental carrier of malaria and it is considered to be an important vector in the hilly regions wherever it occurs in spite of the fact that no naturally infected specimens have ever been found.

25. Anopheles (Myzomyia) philippinensis Ludlow, 1902.

Localities: YUNNAN - Ch'inglungch'ang, Mokiang, Ningerh, Szemao, Wensingko, Yangwupa, Yuenkiang, Shinping, Loliho River, Mokiang, Mangshih.
KWANGTUNG - Hainan Island (numerous localities, Takei 1941).

Distribution: India, Burma, Malaya, Thailand, French Indochina, Netherlands Indies, Philippines, southern China.

Yao and Ling (1937) found the larvae of this species in ponds, rice fields, ditches, and fresh-water pools. These observations are similar to those made in other parts of its range. Observations on feeding habits have not been made in China; in French Indochina precipitin tests have shown it to be zoophilic. There is no evidence to indicate that it has a role in the transmission of disease.

Takei (1941) describes this species as the most numerous anopheline mosquito on Hainan Island. He states that some of the specimens are referable to philippinensis var. hainanensis Takei (1941) which is described only as having wing scales mostly pale as compared to mostly dark in the typical form.

26. Anopheles (Myzomyia) splendidus Koidzumi, 1920.

Anopheles maculipalpis Giles, of Buddle, 1928.
Anopheles maculipalpis var. indiensis Theobald, 1903.
Nyssorhynchus maculipalpis (Giles), of Coggin-Brown, 1911.

Localities: FUKIEN - Amoy, Changchow.
KWANGSI - Wuchow.
KWANGTUNG - Canton, Hainan Island (many localities), Hongkong, Swatow, Lohkongtung (east of Canton).
YUNNAN - Chuchi, Lahsa, Szemao.

Distribution: India, China, French Indochina, Thailand, Formosa.

The larvae of this species usually are found in pools and in river beds with stony or sandy bottoms. They have also been found in earthenware containing rain water in open fields in Amoy. Wherever this species occurs, females may be found inside human dwellings and have anthropophilic feeding habits. In China it has been found naturally infected in Hongkong by Jackson (1935). Since it is rather rare, however, it is not regarded of importance in malaria transmission either in China or elsewhere.

27. Anopheles (Myzomyia) stephensi Liston, 1901.

Localities: YUNNAN - Chefang.

Distribution: Arabia, Irak, Iran, India, Burma, southwestern China.

This species has recently been recorded from China by Williams (1941); little is known of its biology in this country. Elsewhere the larvae have been recorded occasionally from wells, cisterns, flower pots, discarded tin cans, and other temporary receptacles. Adults are found in cowsheds, barracks, and houses and are anthropophilic. In India it is a malaria vector of importance. However, since it is a rare species in China, it is probably of no importance in disease transmission.

28. Anopheles (Myzomyia) subpictus Grassi, 1899.

Anopheles rossi Giles, 1899.
Anopheles rossi var. indefinitus Ludlow, of Macfarlane, 1915.

Localities: KWANGTUNG - Fanling, Kowloon, Mirs Bay, Hongkong, Canton, Hainan Island.

Distribution: India, Malaya, Burma, Thailand, French Indochina, Greater Soenda (?), Lesser Soenda (?), southern China.

In China larvae have been found in hoofprints containing brackish water and no vegetation. Elsewhere they have been found in practically any type of ground water collection, fresh or brackish. The adults will attack either man or animals. This species is probably of no importance in malaria transmission in China. In the Netherlands Indies it has been occasionally found infected in epidemics but always in association with sundaicus, a notoriously efficient transmitter.

It is possible that the Chinese subpictus is referable to a subspecies other than the typical race since Toumanoff has shown the French Indochina form to be intermediate between typical subpictus (type locality, Calcutta) and indefinitus of the Philippines. The material from Hainan Island has been identified by Ho (1938) and Takei (1941) as indefinitus.

29. Anopheles (Myzomyia) tessellatus Theobald, 1901.

Anopheles punctulatus Theobald, of many authors.

Localities: KWANGTUNG - Canton, Hainan Island, Hongkong, Swatow.
YUNNAN - Mangshih.

Distribution: India, Ceylon, Burma, Thailand, Malaya, French Indochina, Greater Soenda, Lesser Soenda, southern China, Philippines.

This species occurs in fairly large numbers in Canton where it breeds in shallow ditches and swamps in the plains. Elsewhere it has, in addition, been recorded from spring pools and stream margins. Feng (1938) states that adults have not been observed to bite man in China although Toumanoff (1934) found a large percentage of captured females to have human blood. Some of his specimens were from Hongkong. Although infected specimens have been found in the Netherlands Indies, it is not considered a malaria vector of importance and consequently should not be regarded as having a malaria-transmitting role in China.

30. Anopheles (Myzomyia) vagus vagus Dönitz, 1902.

Localities: KWANGSI - Szeloh.
KWANGTUNG - Hainan Island (many localities), Hongkong.
YUNNAN - Hokéon, Kaiyuen, Lahati, Mongtseu, Yünnanfu (Kunming), Szemao, Shinping, Mokiang, Hsiakwan, Paoshan, Lungling, Mangshih, Chefang.

Distribution: India, Ceylon, Burma, southern China, French Indochina, Malaya, Thailand, Netherlands Indies.

In southern Kwangsi Province, Feng (1938) found this species in large numbers. Larvae were found in pools, hoofprints, and other small accumulations of water frequently contaminated with cattle feces and urine. Yao and Ling (1937) also found larvae in pools in Yunnan Province. The adults are largely zoophilic. Raynal (1935) using precipitin tests found no specimens with human blood in more than 800 examined in French Indochina and Yunnan. Adults are frequently found in cattle sheds. Although occasional infected specimens have been found in French Indochina and the Netherlands Indies, this species certainly cannot be considered as a vector of malaria.

HYPOTHETICAL LIST

This list contains those species which seem likely to occur in China because of their occurrence in adjacent areas or species which have been reported in China but with seemingly inadequate evidence.

1. Anopheles (Anopheles) anandalei interuptus Puri, 1929.

Yao (1943) includes interuptus in his list of Chinese anopheline mosquitoes. But since the source of his information is not given, interuptus is placed, for the time being, in the hypothetical list. It has been reported previously from Ceylon, Annam, and the eastern Himalayas.

2. Anopheles (Anopheles) messeae Falleroni, 1926.

This species has been reported from central Asia and the Amur River country by Russian investigators.

3. Anopheles (Myzomyia) ludlowii (Theobald), 1903.

This fresh-water species has been reported from Hainan Island by Takei (1941) on the basis of a single specimen collected in the southeasteastern part of the island. This species has been reported previously from the Philippine Islands and Formosa where it has no role in disease transmission.

4. Anopheles (Myzomyia) majidi Young and Majid, 1928.

This species is included in Yao's (1943) list of Chinese anopheline mosquitoes. Since there are no details concerning its occurrence and no other records could be found in the literature, it is placed in the hypothetical list. It has been reported previously from Bengal, Coorg, and the Malabar District in India.

KEYS TO THE ANOPHELINE MOSQUITOES OF CHINA

FEMALES

Included in this key are all of the species of anopheline mosquitoes which are known to occur in China including Hainan Island. However, the records of ludlowii, subpictus indefinitus, leucosphyrus, annandalei interruptus, aconitus, and possibly those of majidi and stephensi need further verification. The relation of subpictus subpictus and subpictus indefinitus in China is obscure. The separation of Christophers (1933) is given although it is possible that it will not apply to Chinese material. Anopheles philippinensis hainanensis Takei 1941 is not included because its description is inadequate. Specimens of the Chinese species of the maculipennis group, sintonoides, annandalei interruptus, sineroides, and majidi were unavailable; the characters for determining these species have been taken from the literature. Philippine material has been used for indefinitus and ludlowii. The following have been reported only from Hainan Island: sintonoides, aconitus, leucosphyrus, ludlowii, and indefinitus. The structure of the key is based in part on Russell, Rozeboom, and Stone (1943).

1. Wings completely dark, without white spots 2
   Wings with distinct white and black spots 3

2. Wing without spots .... aitkenii aitkenii
   [illegible] .... aitkenii bengalensis
   sintonoides
   Wings with scales at forks and at base of second and third veins clumped to form darker spots on the general gray background of the wing .... maculipennis group*

3. Apex of hind tarsus dark 4
   Apex of hind tarsus white 22

4. Wing with less than four dark areas on costa, involving both the costa and vein 1 5
   Wing with at least four dark areas on costa involving both costa and vein 1 13

5. Hind femur with a broad white band at middle 6
   Hind femur without this broad white band 7

6. Base of hind femur extensively pale, the pale area reaching on the under surface to, or nearly to, the pale median band .... lindesaii lindesaii
   Base of hind femur dark to coxa or nearly so .... lindesaii japonicus

* Virtually nothing is known concerning this complex group in China and eastern Asia. Feng (1938) has accepted the occurrence atroparvus van Thiel on the basis of his examination of the male terminalia of a single specimen from Heilungkiang Province. Russian investigators have reported messeae Falleroni from Kirgiz but give no records of atroparvus west of the Caucasus. Feng (1938) also accepts the occurrence of sacharovi Favr in Sinkiang on the basis of a report by Chtcherbankoff (Ouest. Rev. med. et Hyg. Trop., 22: 233-256, 1930). This seems plausible in view of the reports of the occurrence of this species in Kazakhstan and Kirgiz by Montschadsky (1936) and Stackleberg (1937). Other species to be considered are Anopheles lewisi Ludlow (type locality, Selanga, Maritime USSR) and Anopheles selengensis Ludlow (same type locality), species as yet of doubtful validity.

7. Hind femur with apical third covered with long outstanding scales, white distally and black more proximally, forming a tuft almost as large as the head of the mosquito...... annandalei interruptus
Hind femur without such tuft..8

8. Basal fourth of costa mostly pale...9
Basal fourth of costa dark, although scattered pale scales may be present...................10

9. Fringe dark at vein 3 and at all veins below 3, except for the usual pale spot between veins 5.2 and 6.. gigas baileyi
Fringe pale at vein 3 and often at other veins as well..........................gigas simlensis

10. Palpi with distinct white rings...11
Palpi entirely dark...12

11. Hind tarsal segment 4 with a narrow pale ring at apex; subcostal white spot large, involving vein 1 equally with the costa... hyrcanus sinensis
Hind tarsal segment 4 pale at both base and apex; subcostal white spot smaller, not involving vein 1, or much smaller in vein 1 than on the costa .... nigerrimus

12. Basal fourth or third of costa with scattered white scales.......... barbirostris barbirostris
Base of costa with two small white spots.. koreicus

13. Fore tarsi with well developed pale bands extending across the joints, i.e., at apex and base of adjacent segments... 14
Fore tarsi unbanded or with only very narrow bands restricted to the apices of the segments.. 16

14. Femora and tibiae speckled.. 15
Femora and tibiae not speckled...subpictus subpictus
subpictus indefinitus
vagus vagus

15. Palpus with a narrow apical, two broad subapical, and a narrow basal white band............. tessellatus (in part)
Palpus with a broad apical, a narrow subapical, and a narrow median white band............ ludlowii

16. Costa with four pale spots, the first two small and situated at the extreme base of the wing; no sectoral spot..sineroides
Costa with more than four pale spots; if with only four pale spots, both the first and second are not situated at extreme base of wing; sectoral spot present..................................17

17. Median area of mesonotum with narrow pale scales...18
Thorax without distinct scales; with hairs or hair-like scales only..................................19

18. Femora and tibiae speckled... stephensi
Femora and tibiae not speckled...jeyporiensis candidiensis

19. Palpus with the two apical white bands as broad as, or broader than, the intervening dark area.. 20
Palpus with subapical pale band narrower than the dark area between it and the apical pale band... 21

20. Pale fringe spot at apex of vein 6; apical half of proboscis pale .... aconitus
Pale fringe spot usually lacking at apex of vein 6; proboscis dark or pale only in certain lights .... minimus minimus

21. Fringe spots present at all veins but 6; some erect pale scales on anterior promontory of thorax; vein 1 with a long pale area at base of wing .... fluviatilis
Fringe spots at one or two veins only; anterior promontory without pale scales; pale area on vein 1 at base of wing interrupted by a dark spot .... culicifacies

22. Hind tarsus with at most only one segment entirely white 23
Hind tarsus with at least two segments entirely white 29

23. Femora and tibiae not speckled 24
Femora and tibiae speckled 26

24. Palpus with two broad apical white bands and two narrow basal white bands .... karwari
Palpus with two broad apical white bands and one narrow basal white band 25

25. Dark spot at furcation of vein 5. Apical half of second branch of vein 5 dark .... majidi
Dark spot lacking at furcation of vein 5. Apical dark area on second branch of vein 5 reduced to one-fourth length of second branch .... pattoni

26. Vein 6 with four or five dark spots 27
Vein 6 with two or three dark spots 28

27. Hind leg with a conspicuous white band at apex of tibia and base of first tarsal segment .... leucosphyrus leucosphyrus
Hind leg with tibiotarsal joint without such a broad band .... tessellatus (in part)

28. Abdominal sternites with conspicuous black scale tufts; palpus with three broad and one narrower white bands, and three yellow bands .... kochi
Abdominal sternites without scale tufts; palpus with three white bands .... maculatus maculatus

29. Femora and tibiae not speckled 30
Femora and tibiae speckled 31

30. Stem and lower branch of vein 5 mostly dark or at least with a dark spot at the origin of the branch .... annularis
Stem and lower branch of vein 5 mostly white, a dark spot at each end .... philippinensis philippinensis*

31. Palpus with two broad apical pale bands and conspicuous speckling .... splendidus
Palpus with one broad apical band, two narrow bands, and without speckling .... jamesii

* Takei (1941) describes philippinensis hainanensis as having paler wings than typical philippinensis.

Separation of subpictus, indefinitus, and vagus

The following separation of this difficult group is that proposed by Christophers and is accepted only provisionally here since Toumanoff's description of the Indochina subpictus indicates a possibly intermediate position between subpictus and indefinitus.

1. Larvae with outer clypeal hair much shorter than half of inner. Apical pale band on female palpus 3 - 5 times preceding dark band. Dark area on vein one in basal dark spot usually less than half as long as that on costa. Lateral hair on segment IV of larva with two branches. Leaflets of phallosome large, the first very long, the others progressively shorter .... vagus

   Larvae with outer clypeal hair somewhat more than half the length of inner. Apical pale band on female palpus same length as preceding dark band, or not more than twice this. Dark area on vein one in basal dark spot usually more than half as long as that on costa. Lateral hair on segment IV of larva with three branches. Leaflets of phallosome large or small 2

2. Preapical dark band on female palpus variable averaging about half the length of apical pale band. Leaflets phallosome short (average, 36 micra) and more or less even in length. Prehumeral accessory dark costal spot usually undivided and extending to extreme base of costa .... subpictus indefinitus

   Preapical dark band on female palpus about same length as apical pale band. Leaflets of phallosome long (57 micra) and more as in vagus. Prehumeral accessory costal spot nearly always divided or in part obliterated, the base of the costa with more pale scaling and prehumeral not extending to extreme base; subapical dark costal spot shorter than pale spot on either side .... subpictus subpictus

KEY TO THE FOURTH INSTAR LARVAE OF THE ANOPHELINE MOSQUITOES OF CHINA

The following key is based, with some revision on Russell, Rozeboom, and Stone (1943). The larvae of koreicus, sineroides, and philippinensis hainanensis are not known. Information on the larva of ludlowii is not sufficiently adequate to include in the key; this species has been recorded once in China, a single specimen from Hainan Island. No larval specimens of annandalei interruptus were available; the available descriptions are not sufficiently adequate to place it with certainty in this key. However, it appears that the separation of interruptus and sintonoides given will prove accurate.

1. Inner anterior clypeal hairs approximate; the distance between their bases never more than that between the bases of inner and outer clypeal hairs on one side; antennal hair usually branched 2
   Inner anterior clypeal hairs separated; the distance between their bases at least twice that between the bases of the inner and outer clypeal hairs of one side; antennal hair simple 11

2. Outer anterior clypeal hairs simple, bifid, or with a few short branches 3
   Outer clypeal hairs thickly branched into a fan-shaped tuft 9

3. Inner anterior clypeal hairs simple, their bases nearly touching 5
   Inner anterior clypeal hairs split about their middle into two to five branches; bases of inner anterior clypeals about as far from one another as they are from the bases of outer anterior clypeals 4

4. Inner anterior clypeal hairs split into two above the base .... aitkenii aitkenii
   Inner anterior clypeal hairs split about their middle into three to five branches .... aitkenii bengalensis

5. Thorax and abdomen densely covered with setae ventrally and laterally 6
   Ventral surface with scattered inconspicuous setae 7

6. Innermost hair of abdominal segments with six to ten radiating spines .... sintonoides
   Innermost hair of abdominal segments without such spines .... annandalei interruptus

7. Palmate hairs present on abdominal segments 2 to 7; thoracic palmate hair well developed.. lindesaii lindesaii
   lindesaii japonicus
   Palmate hairs present on abdominal segments 3 to 7; thoracic palmate hair not differentiated 8

8. Long lateral hair on abdominal segment 5 simple .... gigas baileyi
   This hair split into two to three branches .... gigas simlensis

9. Prothoracic hair 1 simple or split into two or three branches at tip 10
   Prothoracic hair 1 branched near base into six to fourteen branches .... barbirostris barbirostris

10. Antennal hair very long, strongly feathered, situated at about middle of antenna; all the long prothoracic pleural hairs simple .... nigerrimus
    hyrcanus sinensis
    Antennal hair of moderate length, weakly branched, situated before the middle of the antenna; one of the long prothoracic pleural hairs branched .... maculipennis group*

* See note in adult key.

11. Anterior tergal plates on abdominal segments 3 to 7 very large, with convex posterior border, and enclosing the small median posterior plate........ 12
Anterior tergal plates on abdominal segments 3 to 7 not exceptionally large, with concave posterior border, and not enclosing the small median posterior plate........ 13

12. Clypeal hairs simple........ minimus
fluviatilis
Anterior clypeal hairs with short scattered branches........ aconitus

13. Inner and outer anterior clypeal hairs simple or with short inconspicuous fraying........ 14
Inner and outer anterior clypeal hairs with lateral branches or conspicuous fraying........ 23

14. Distinct (though small) palmate hairs on abdominal segment 1........ 15
Abdominal segment 1 without palmate hair........ 20

15. All thoracic pleural hairs simple; filaments of abdominal palmate hairs blunt........ kochi
Some of the thoracic pleural hairs branched; filaments of abdominal palmate hairs sharp-pointed........ 16

16. Thoracic palmate hair not differentiated; both long metathoracic pleural hairs branched or feathered........ 18
Thoracic palmate hair distinct; one long metathoracic pleural hair branched, the other simple........ 17

17. Inner anterior clypeal hair of normal length, much less than one-half as long as frontoclypeus; filaments of abdominal palmate hairs about one-half or more than half as long as the blades of the leaflets........ culicifacies
Inner anterior clypeal hair exceptionally long, about one-half as long as frontoclypeus; filaments of abdominal palmate hairs only about one-fourth as long as blade of leaflets........ majidi

18. All long prothoracic pleural hairs simple or one may be split into two or three branches; inner and outer clypeal hairs simple........ 19
One of the long prothoracic pleural hairs feathered; inner and outer clypeal hairs with minute lateral branches........ pattoni (?)

19. Outer anterior clypeal and posterior clypeal hairs not more than one-third as long as the inner anterior clypeals; posterior clypeal hairs close to the inner clypeals........ vagus
Outer anterior clypeal and posterior clypeal hairs about one-half or more as long as the inner anterior clypeals; posterior clypeals external to, and quite far from, inner anterior clypeals, so that they reach just beyond base of the latter.... subpictus subpictus
subpictus indefinitus

20. A distinct (though small) palmate hair on abdominal segment 2; one long pleural hair on mesothorax branched, the other simple........ 21
Abdominal segment 2 without palmate hairs; both long meso and metathoracic pleural hairs simple........ 22

21. Outer anterior clypeal hair always simple, inner usually so; second hair dorsal to the lateral hair on abdominal segment 1 with three to five branches; palmate hair never differentiated on metathorax........ stephensi
Inner and outer anterior clypeal hair finely frayed; second hair dorsal to the lateral hair on abdominal segment 1 with six to eight branches; palmate hair may be slightly differentiated on metathorax........ maculatus maculatus (in part)

22. Prothoracic hair number 1 with only two to four branches; a poorly developed palmate hair on metathorax........ tessellatus
Prothoracic hair number 1 with numerous branches, root large and dark brown; palmate hair on metathorax not differentiated........ leucosphyrus

23. Outer anterior clypeal hairs with long branches, almost as long as the hair itself.......... 24
Outer anterior clypeal hairs with short lateral branches, at most about one-sixth the length of the hair.. 26

24. Inner occipital hair simple or bifid near tip.. 25
Inner occipital hair split near base into two to eight branches..................... philippinensis

25. Abdominal segment 1 with well-developed palmate hair; dark gray larva............ annularis
Abdominal segment 1 without a differentiated palmate hair; pale, dirty yellow larva........... jamesii

26. Outer anterior clypeal hairs with many short lateral branches along entire length; one long metathoracic pleural hair simple .... jeyporiensis candidiensis
Outer anterior clypeal hairs with only a few short, scattered branches; both long pleural hairs of metathorax feathered.. 27

27. Outer anterior clypeal hair often split into two, and with three to seven short lateral branches; inner occipital hair split into two to four branches....................... splendidus
Outer anterior clypeal hairs with a few fine lateral branches.................................... 28

28. Long lateral hair on abdominal segments 5 and 6 with a central main stem and six to ten or more long branches arising along the length of the stem.......................... karwari
Long lateral hair of abdominal segments 5 and 6 split near base into three to five branches.. maculatus maculatus (in part)

KEY TO THE COMMON ANOPHELINE MOSQUITOES

OF THE COASTAL PROVINCES

This key is based in part on that of Jackson (1936) for Hongkong Colony. It is designed to include those species which have been recorded as common from Canton area north. Only one, fluviatilis, can be regarded as rare having been recorded only from Hongkong but because of the desirability of separating it from minimus, it has been included. Anopheles pattoni is not a coastal species but is an important species in the hilly country in the coastal provinces of Shantung and Hopeh. Whether or not both typical lindesaii and japonicus occur is not known. The key gives a separation for them. Uncommon or rare species which have been reported from the coastal provinces and which are omitted from this key are: barbirostris (Kwangtung, Chekiang), koreicus (Chekiang), nigerrimus (Hainan Island), sineroides (Chekiang), sintonoides (Hainan Island), aconitus (Hainan Island), annularis (Kwangtung), jamesii (Kwangtung), kochi (Kwangtung), leucosphyrus (Hainan Island), philippinensis (numerous on Hainan Island), subpictus (Kwangtung), indefinitus (Hainan Island), and ludlowii (Hainan Island). For southern Kwangtung Province including Hainan Island, the complete key should be used. It has been necessary to omit pattoni from the larva key because no specimens were available for examination.

ADULT FEMALES

1. Wings and palps plain .... aitkenii
   Wings and palps ornamented 2

2. Wings with black spots only .... maculipennis group*
   Wings with dark and white spots 3

3. Wing with less than four dark areas on costa involving both costa and subcosta 4
   Wing with at least four dark areas on costa involving both costa and subcosta 6

4. Wing with a pale spot at junction of subcostal and costal veins, a pale spot above junction of first vein with costa, broad pale spot on the fringe below junction of first vein with costa and perhaps one on the fringe opposite to the lower branch of the fifth vein, no other pale spots on fringe or costa. Female palps markedly shaggy. Hind femur without broad white band .... hyrcanus sinensis
   Wing with single pale spot at junction of first vein and costa and extending to apex of first branch of second vein. Hind femur with broad white band at middle 5

5. Base of hind femur extensively pale, the pale area extending in the undersurface to, or nearly to, the pale median band .... lindesaii lindesaii
   Base of femur dark to coxa or nearly so .... lindesaii japonicus

6. Fifth tarsal segment of hind leg entirely white 7
   Fifth tarsal segment of hind leg mainly dark 9

7. Hind femur and tibia plain 13
   Hind femur and tibia dark with white spots 8

* See discussion of Chinese maculipennis group in previous note. It is possible that some form of this group may occur on the coast of north China or Manchuria.

8. Third and fourth tarsal segments of hind leg white .... splendidus
Third and fourth tarsal segments of hind leg white with dark centers .... maculatus

9. Hind femur and tibia spotted, distal half of female proboscis light in color...... tessellatus
Hind femur and tibia not spotted, distal half of female proboscis not light in color 10

10. Tarsi of front legs with pale bands much longer than broad and extending across the joints .... vagus
Tarsi of front legs not so 11

11. Front legs with narrow but distinct tarsal bandings on apices of segments. Dorsum of thorax with white narrow scales. White spot on fringe opposite sixth vein..............
jeyporiensis candidiensis
Front legs without distinct tarsal bandings. Thorax with hairs or hair-like scales on dorsum apart from tufts of scales on front edge. No white spot on fringe opposite sixth vein 12

12. Apical and subapical pale palpal bands long, about equal in length, and equal to or longer than intervening dark band, which is about one-third the length of succeeding dark band. Interruption of pale scales at base of costa, perhaps a few on one wing only.....
minimus
Apical and subapical pale palpal bands unequal in length, subapical pale band short, intervening dark band four or five times the length of subapical pale band and half the length of succeeding dark band. No interruption at base of costa .... fluviatilis

13. Palpus with two broad apical white bands and two narrow basal white bands .... karwari
Palpus with two broad apical bands and one narrow basal white band .... pattoni

FOURTH INSTAR LARVAE

1. Inner anterior clypeal hairs approximate; the distance between their bases never more than that between bases of inner and outer clypeal hairs on one side; antennal hair branched 2
Inner anterior clypeal hairs separated; the distance between their bases at least twice that of inner and outer clypeal hairs on one side; antennal hair simple 4

2. Outer anterior clypeal hairs simple, bifid, or with a few short branches .... aitkenii
Outer anterior clypeal hairs thickly branched in fan-shaped tuft 3

3. Antennal hair very long, strongly feathered, situated at about middle of antenna; all the long prothoracic hairs simple .... hyrcanus sinensis
Antennal hair of moderate length, weakly feathered, situated basad to middle of antenna; one of the long prothoracic hairs branched .... maculipennis group

4. All pairs of clypeal hairs simple.. 5
All pairs of clypeal hairs not simple... 6

5. Posterior clypeal hairs situated in line with inner anterior clypeal hairs. Anterior tergal plates on segments 3 - 7 very large with convex posterior borders extending to almost the middle of the segments and enclosing the posterior tergal plates ....
minimus
fluviatilis

Posterior clypeal hairs placed internal to the inner clypeals and close behind them. Outer anterior and posterior clypeal hairs about 1/3 or 1/4 the length of inner anterior. Anterior tergal plates not as above .... vagus

6. All pairs of clypeal hairs branched or frayed. Inner and outer clypeal hairs stout, with conspicuous fraying throughout. Large anterior tergal plates on segments 3 - 7 with posterior borders concave; posterior tergal plates not included in anterior .... jeyporiensis candidiensis
   Outer and inner anterior clypeal hairs branched or frayed, posterior clypeal hairs simple 7
   Inner anterior clypeal hairs finely frayed; outer anterior clypeal hairs simple and short, close to anterior and 1/4 to 1/5 its length; posterior clypeal hair about same length as outer anterior clypeal hair and placed far behind inner anterior clypeal hair ...... tessellatus

7. Leaflets with pointed filaments .... maculatus
   Leaflets with blunt filaments 8

8. Lateral hairs on 5th and 6th segments splitting near base into 2 - 6 branches.... splendidus
   Lateral hairs on 5th and 6th segments splitting into 6 - 11 branches.................. karwari

APPENDIX C

CHECKLIST OF THE CULICINE MOSQUITOES OF CHINA

The following list is based largely on Feng (1938) with some additions from subsequent papers. The synonymy is largely according to Edwards (1932) and includes only names which have been applied in China or to material collected in China.

1. Megarhinus splendens (Wiedemann), 1819.

Culex splendens Wiedemann, 1819.
Toxorhynchites gilesii (Theobald), 1901.

Localities: KWANGTUNG - Hongkong.

Distribution: Malaya, Thailand, French Indochina, Philippine Islands, south China.

This is a jungle species and is not known to suck blood; both sexes are flower feeders. Larvae are found in tree holes, bamboos and sometimes in domestic collections of water; they feed upon the larvae of other species of mosquitoes.

2. Tripteroides (Tripteroides) bambusa Yamada, 1917.

Rachionotomyia bambusa Yamada, 1917.

Localities: ANHWEI - Hwangshan.
CHEKIANG - Mokanshan (Wuk ang), Hangchow, Tientaishan, Hwangyen, Tienmushan, Yentangshan.
KWANGTUNG - Hongkong.

Distribution: China, Japan.

Larvae have been found in bamboo trunks and tree holes and occasionally in artificial containers. Adults have not been observed to bite man.

3. Tripteroides (Tripteroides) vicina (Edwards), 1914.

Rachionotomyia vicina Edwards, 1914.

Localities: KWANGTUNG - Hongkong.

Distribution: China, Malaya.

This is a wild species which is known to bite man. The larvae are found in tree holes and have been observed to feed upon the larvae of other mosquitoes.

4. Harpagomyia genurostris (Leicester), 1908.

Malaya genurostris Leicester, 1908.

Localities: KWANGTUNG - Hongkong.

Distribution: India, Burma, Indochina, China, Malaya, Sumatra, Formosa (?).

The larvae of this species have been found in the water in pineapple plants. The habits of the adults have not been observed in China; however, elsewhere observations indicate that this species is nursed by ants.

5. Uranotaenia annandalei Barraud, 1926.

Localities: FUKIEN - Kushan (Foochow).
KWANGTUNG - Hongkong.

Distribution: India, Burma, Thailand, south China.

The larvae of this species have been collected in the beds of streams with sandy bottoms in the hill country. Nothing is known of the habits of the adults.

6. Uranotaenia bimaculata Leicester, 1908.

Localities: ANHWEI - Hwangshan.
CHEKIANG - Hangchow.

Distribution: India, China, Malaya.

Although larvae of this species is unknown, it is believed to breed in tree holes and bamboos. The habits of the adults are unknown.

7. Uranotaenia jacksoni Edwards, 1935.

This species is known from a single male specimen captured in Hongkong.

8. Uranotaenia macfarianei Edwards, 1914.

Localities: CHEKIANG - Hangchow.
KIANGSI - Kiukiang.
KWANGTUNG - Hongkong.

Distribution: China, Malaya, Greater Soenda.

Larvae of this species have been taken from stream beds with sandy bottoms in the hill country. The adults habits are unknown.

9. Uranotaenia testacea Theobald, 1904.

Localities: KWANGTUNG - Hongkong.

Distribution: India, Burma, Thailand, China, Malaya.

There is no information on the habits of either adults or larvae.

10. Culiseta (Culiseta) niveitaeniata (Theobald), 1907.

Pseudotheobaldia niveitaeniata Theobald, 1907.
Theobaldia (Theobaldia) niveitaeniata Theobald, 1907.

Localities: YUNNAN.

Distribution: India, China.

The larvae of this species has been collected in pools in the beds of hill country streams.

11. Orthopodomyia anopheloides (Giles), 1903.

Mansonia anopheloides Giles, 1903.

Localities: CHEKIANG - Hangchow.

Distribution: India, Burma, Indochina, China

Larvae have been found in bamboo stumps; the habits of the adults are unknown.

12. Ficalbia (Ficalbia) minima (Theobald), 1901.

Uranotaenia minima Theobald, 1901.

Localities: KWANGTUNG - Hongkong.

Distribution: India, Thailand, south China, Malaya, Borneo.

No information is available on the habits of this species.

13. Ficalbia (Etorleptiomyia) luzonensis (Ludlow), 1905.

O'Reillia luzonensis Ludlow, 1905.

Localities: KWANGTUNG - Hongkong.

Distribution: India, Thailand, Indochina, south China, Formosa, Malaya, Lesser Soenda, Philippines.

The habits of this species have not been observed in China. Elsewhere it is presumed that the larvae are found in weedy ponds in swamps.

14. Mansonia (Mansonioides) uniformis (Theobald), 1901.

Panoplites uniformis Theobald, 1901.
Taeniorhynchus uniformis (Theobald), 1901.

Localities: CHEKIANG - Hangchow, Huchow.
FUKIEN - Changchow, Amoy.
HOPEI - Peiping.
HUPEH - Wuhan area.
KIANGSI - Kiukiang.
KIANGSU - Woosung (near Shanghai), Nanking.
KWANGTUNG - Wangmoon, Samshui, Hongkong.

Distribution: Widespread from Africa to Australia.

The larvae as well as the pupae attach themselves by means of siphon tube to various kinds of aquatic plants which grow in ponds, pools, and marshes. The females are strongly anthropophilic and are especially active during the night in rainy seasons. The role of this species as an intermediate host of Wuchereria malayi has been well established by Dutch investigators in the Netherlands Indies and has been confirmed in China by Feng (1934).

15. Mansonia (Coquillettidia) aurites (Theobald), 1907.

Chrysoconops aurites Theobald, 1907.
Taeniorhynchus aurites (Theobald), 1907.

Localities: CHEKIANG - Hangchow.

Distribution: Recorded from China only.

This species is known from a single female specimen.

16. Mansonia (Coquillettidia) crassipes (van der Wulp), 1892.

Culex crassipes van der Wulp, 1892.

Localities: KWANGTUNG - Hongkong.

Distribution: Widespread in the Oriental and Australasian regions.

The breeding habits of this species are similar to those of Mansonia uniformis. The adults have been collected in houses in Hongkong and presumably bite man.

17. Mansonia (Coquillettidia) ochracea (Theobald), 1903.

Taeniorhynchus ochracea Theobald, 1903.

Localities: CHEKIANG - Hanchow.

Distribution: India, Thailand, Indochina, Formosa, Borneo, Philippines.

No information has been recorded on the habits of this species although they are assumed to be similar to those of other members of the genus.

18. Heizmannia lii Wu, 1936.

Localities: CHEKIANG - Hangchow, Tienmushan.

Distribution: Known only from China.

The larvae were collected in bamboo stumps; the habits of the adults are unknown.

19. Armigeres (Armigeres) aureolineatus (Leicester), 1908.

Desvoidea aureolineatus Leicester, 1908.

Localities: KWANGTUNG - Wangmoon (near Canton ?).

Distribution: India, Indochina, China, Malaya, Borneo.

The breeding habits of this species have not been observed in China; however, in India and elsewhere the larvae are found in large collections of water such as coconut shells. The habits of the adults have not been recorded.

20. Armigeres (Armigeres) subalbatus (Coquillett), 1898.

Culex subalbatus Coquillett, 1898.
Culex obturbans Walker, 1860 (Of various authors as referred to Chinese material).
Desvoidia obturbans (Walker), (Of various authors as referred to Chinese material).
Armigeres obturbans (Walker) (Of various authors as referred to Chinese material).

Localities: CHEKIANG - Chinhwa, Hangchow, Mokanshan (Wuk'ang), Huchow, Shaohyling, Haining, Chuchi, Fuyang, Hwangyen, Iwu, Chienteh, Pingyang, Tientaishan, Tienmushan, Yentangshan.
FUKIEN - Changchow, Foochow, Amoy, Yungchun.
HUNAN - Shoayang, P'ingkiang.
HUPEH - Wuhan area.
KIANGSI - Kiukiang.
KIANGSU - Shanghai, Nanking.
KWANGTUNG - Canton, Swatow, Hongkong, Hainan.
SZECHWAN - Hsin Kai Si (Mt. Omei), Futsing.

Distribution: Burma, Thailand, Indochina, China.

The nomenclatorial confusion involving subalbatus Coquillett, 1898, kuchingensis Edwards, 1915, and obturbans Walker, 1860, makes it difficult to ascertain the distribution of this species without the examination of material from a large number of localities. Armigeres obturbans was described from the Moluccas; this name is not referable to the Chinese species which apparently should be known as subalbatus.

The larvae of this species have been found in very foul water. They are predaceous on the larvae of other mosquitoes. Frequently they have been found in fertilizer pips. This is a very common domestic species in many localities in central and south China especially where sanitary conditions are poor. The females are both anthropophilic and zoophilic and are most active at night. This species has been found naturally infected with Wuchereria bancrofti but it has been proven that the larvae do not develop to the infective stage.

21. Armigeres (Leicesteria) magnus (Theobald), 1908.

Brevirhynchus magnus Theobald, 1908.

Localities: KWANGTUNG - Hongkong.

Distribution: India, Indochina, China, Malaya, Greater Soenda, Philippines.

The larvae of this species have been found in pitcher plants.

22. Aedes (Mucidus) scataphagoides Theobald, 1901.

Localities: KWANGTUNG - Hongkong.

Distribution: India, Burma, China.

The habits of this species have not been observed in China but elsewhere the larvae are found in natural pools especially during the rainy season. The adults are strongly anthropophilic.

23. Aedes (Ochlerotatus) dorsalis (Meigen), 1830.

Culex dorsalis Meigen, 1830.
Grabhamia broquettii Theobald, 1913.

Localities: HOPEI - Tientsin, Peiping, possibly Tinghai.
LIAONING - Mukden.

Distribution: Palearctic.

The larvae of this species are found in natural pools and in marshes. The female is anthropophilic and diurnal in its habits.

24. Aedes (Ochlerotatus) maculatus (Meigen), 1804.

Localities: HOPEI - Peiping.
KIRIN - Changchun.
LIAONING - Mukden.

Distribution: Palearctic region.

The breeding habits of this species are similar to those of Aedes dorsalis. The females bite man during the day and are numerous in marshy places with a thick growth of weeds.

25. Aedes (Aedimorphus) vexans Meigen, 1830.

Culicada vexans var. nipponii Theobald, 1907.
Aedes vexans var. nipponii (Theobald), 1907

Localities: CHEKIANG - Hangchow, Hwangyen, Iwu, Pingyang, Tienmushan.
HOPEI - Peiping.
KIANGSU - Shanghai, Nanking.
KWANGTUNG - Canton, Swatow.
LIAONING - Hailung.
TIBET - Chumbi Valley, Yatung.
YUNNAN - Gadzu Beta.

Distribution: Probably throughout the Oriental region.

Larvae are found chiefly in natural water pools and swamps. This species has been observed to bite man both during the day and at night. Hu (1935) has demonstrated that the larvae of bancrofti do not develop in this species.

26. Aedes (Banksinella) lineatopennis (Ludlow), 1905.

Taeniorhynchus lineatopennis, Ludlow, 1905.

Localities: FUKIEN - Amoy.

Distribution: India, Burma, China, Malaya, Greater Soenda, Lesser Soenda, Phillipines, Andaman Islands.

This species breeds in natural water pools. According to Feng (1938), the larvae have been found in rain water filled depressions in fields in Amoy. The females bite man as well as cattle during the daytime.

27. Aedes (Finlaya) elsiae Barraud, 1923.

Localities: ANHWEI - Hwangshan.
CHEKIANG - Yentangshan.
KIANGSI - Kiukiang.

Distribution: India, Indochina, China.

Larvae have been collected in rock pools in the beds of hill country streams. The habits of the adults have not been recorded.

28. Aedes (Finlaya) fengi Edwards, 1935.

Localities: ANHWEI - Hwangshan.
CHEKIANG - Mokanshan, Hangchow, Tienmushan.

Distribution: Recorded only from China.

The larvae have been collected in bamboo stumps. The habits of the adults apparently have not been recorded.

29. Aedes (Finlaya) hatorii Yamada, 1921.

Localities: ANHWEI - Hwangshan.
CHEKIANG - Tienmushan.

Distribution: China, Formosa.

Nothing has been recorded concerning the habits of this species.

30. Aedes (Finlaya) japonicus (Theobald), 1901.

Culex japonicus Theobald, 1901.
Aedes eucleptes Dyar, 1921.

Localities: ANHWEI - Hwangshan.
CHEKIANG - Hangchow, Hwangyen, Tienmushan, Yentangshan.
FUKIEN - Kushan (Foochow).
KIANGSI - Kiukiang.
KWANGTUNG - Canton, Hongkong.

Distribution: Formosa, China, Japan.

The usual breeding places are collections of water in stone cavities in the vicinity of hill country streams although larvae have also been found in containers holding clear water. Adult females bite man but are not regarded as important pests; they are apparently primarily zoophilic.

31. Aedes (Finlaya) koreicus Edwards, 1917.

Aedes (Finlaya) japonicus var. koreicus Edwards, 1917.

Localities: HOPEI - Peiping.
LIAONING - Mukden.
SHANTUNG - Tsinan, Taishan.

Distribution: Korea, China.

The larvae are common in household containers such as flower pots, barrels, etc., as well as in water pools in rocks in the hills. The eggs of this species can resist cold and dryness and have been found to pass the winter without being killed. The females bite man at night and occasionally during the day. This species has been found experimentally to be a transmitter of Dirofilaria immitis in dogs of Peiping.

32. Aedes (Finlaya) macdougalli Edwards, 1922.

Aedes dougalli Buddle, 1928.

Localities: KWANGTUNG - Howlick (West River), Hongkong.

Distribution: India, China, Sumatra.

Larvae have been collected in cavities in the rocks in mountainous streams. The habits of the adults have apparently not been recorded.

33. Aedes (Finlaya) macfarlanei (Edwards), 1914.

Ochlerotatus macfarlanei Edwards, 1914.
Aedes (Ochlerotatus) macfarlanei (Edwards), 1914.

Localities: KWANGTUNG - Hongkong.

Distribution: Indochina, China, Sumatra.

The larvae have been found in pools among the rocks in stream beds in the hill country; the habits of the adults are unknown.

34. Aedes (Finlaya) niveoides Barraud, 1934.

Localities: KWANGTUNG - Hongkong.

Distribution: India, China.

Larvae have been collected in tree holes and bamboo stumps. No observations on the habits of the adults have been recorded.

35. Aedes (Finlaya) niveus (Ludlow), 1903.

Stegomyia niveus Ludlow, 1903.
Aedes pseudoniveus Theobald, 1910.

Localities: ANHWEI - Hwangshan.
CHEKIANG - Hangchow, Tienmushan.
FUKIEN - Foochow.
HOPEI - Peiping.
KWANGTUNG - Canton, Hongkong.

Distribution: India, Thailand, Indochina, China, Malaya, Lesser Soenda, Greater Soenda, Philippines, Andaman Islands, Japan.

This species breeds in tree holes and bamboo stumps.

36. Aedes (Finlaya) peipingensis Feng, 1938.

Localities: HOPEI - Peiping.

Distribution: Known from China only.

The larvae of this species were collected in tree holes. An adult female was observed to suck human blood at dusk.

37. Aedes (Finlaya) prominens Barraud, 1923.

Localities: CHEKIANG - Hangchow.

Distribution: India, Indochina, China.

This species breeds in bamboo stumps. The habits of the adults apparently have not been recorded.

38. Aedes (Finlaya) pulchriventer (Giles), 1901.

Culex pulchriventer Giles, 1901.

Localities: TIBET - Chumbi Valley.

Distribution: India, China.

The larvae of this species have been collected from fresh water pools in stream beds.

39. Aedes (Finlaya) seoulensis Yamada, 1921.

Localities: HOPEI - Peiping.
LIAONING - Mukden.

Distribution: Korea, China.

This species is a tree hole breeder. In Peiping, during the rainy season, larvae are found commonly in tree holes of any kind; the eggs are resistant to cold and dryness. Experimentally the adults have been observed to bite man at night although this has not been confirmed by observations in nature.

40. Aedes (Finlaya) togoi (Theobald), 1907.

Culicelsa togoi Theobald, 1907.
Aedes (Ochlerotatus) togoi (Theobald), 1907.

Localities: CHEKIANG - Hangchow.
FUKIEN - Amoy.
HOPEI - Peiping.
KWANGTUNG - Hongkong.
SHANTUNG - Tsingtao.

Distribution: Japan, China, eastern U.S.S.R.

The larvae of this species are found in brackish water pools formed among the rocks by high tide. Ho (1931) has found larvae in collections of rain water in Peiping which may belong to this species. This mosquito is a serious pest along the coast.

41. Aedes (Finlaya) yunnanensis Gaschen, 1935.

Localities: YUNNAN - Kunming (Yunnanfu).

Distribution: Known only from China.

The larvae were collected in rain water in rock cavities. The habits of the adults have not been recorded.

42. *Aedes* (*Stegomyia*) *albopictus* (Skuse), 1895.

Culex albopictus Skuse, 1895.
Stegomyia scutellaris Theobald, 1901 (nec Walker).

Localities: ANHWEI - Hwangshan.
CHEKIANG - Chinhua, Hangchow, Mokanshan, Huchow, Shaohyling, Chuchi, Fuyang, Haimen, Iwu, Chienth, Pingyang, Tientaishan, Hwangyen, Tienmushan, Yentangshan
FUKIEN - Changchow, Foochow, Amoy.
HOPEI - Peiping.
HUPEH - Wuhan area.
KIANGSI - Kiukiang.
KIANGSU - Shanghai, Nanking, Soochow.
KWANGTUNG - Canton, Swatow, Hongkong, Hainan Island.
SHANTUNG - Taian, Tsinan, Linchü.
SZECHWAN - Hsin Kai Si (Mt. Omei), Futsing.

Distribution: Throughout the Oriental region; has been introduced into Saipan in the Marianas and into Hawaii.

This species breeds in many types of small collections of fresh water such as domestic utensils, flower pots, open bottles, old tin cans, roof gutters, etc. Infrequently the larvae are found in collections of natural water in the earth. Away from human habitations, the usual breeding places are tree holes, bamboo holes, stone cavities, etc. The adults are vigorous daytime blood suckers and are important domestic pests. This species has been proven to be a dengue vector in the Philippine Islands and there is epidemiological evidence indicating that it has a similar role in China. Hu (1935) has demonstrated that this species does not serve as an intermediate host for *Wuchereria bancrofti*. This observation was confirmed by Prawirohardjo (1939). Hu (1941) was unable to obtain experimental infections in this species with *Wuchereria malayi*.

43. *Aedes* (*Stegomyia*) *annandalei* Theobald, 1910.

Localities: CHEKIANG - Mokanshan (Wuk ang), Hangchow, Tienmushan, Huchow.

Distribution: India, Indochina, China, Greater Soenda, Lesser Soenda, Andaman Islands.

Larvae are found in bamboo stumps in the hill country. The females are diurnal in their feeding habits and are important as pests in bamboo bushes.

44. *Aedes* (*Stegomyia*) *chemulpoensis* Yamada, 1921.

Localities: HOPEI - Peiping.
KIANGSU - Shanghai.
LIAONING - Mukden.
SHANTUNG - Taian, Weihsien, Linchü.

Distribution: Japan, China.

This is a tree-hole species. The females are vigorous daytime feeders. In places where this species is abundant, it is an important pest.

45. Aedes (Stegomyia) aegypti (Linnaeus), 1762.

Culex aegypti Linnaeus, 1762.
Aedes argenteus(Poiret), 1787.
Aedes fasciatus (Fabricius), 1805.
Stegomyia fasciatus (Fabricius), 1805.

Localities: FUKIEN - Amoy.
KIANGSU - Shanghai.
KWANGTUNG - Canton, Hongkong, Kowloon, Hainan Island.

Distribution: Cosmopolitan in tropics and subtropics.

The breeding habits of this species are well known; it is the most domestic of all mosquitoes. The adult females bite man chiefly during the daytime but many also come into dwellings and suck blood at night. In China this species is particularly abundant in Amoy. The role of this species in the transmission of dengue is well known. Experimental evidence indicates that it is not a vector of filariasis.

46. Aedes (Stegomyia) pseudalbopictus Borel, 1928.

Localities: CHEKIANG - Tienmushan, Hangchow.

Distribution: Indochina, China, Java.

The habits of this species are apparently similar to those of albopictus although it seems to be wilder preferring the water in bamboo stumps for breeding.

47. Aedes (Stegomyia) w-albus Theobald, 1905.

Aedes christianus Dyar, 1921.

Localities: KWANGTUNG - Canton, Hongkong.

Distribution: India, Thailand, China, Formosa, Malaya.

The breeding habits of this species are not known. It is presumed that the female is a diurnal feeder as is the case with other members of the subgenus.

48. Culex (Lutzia) fuscanus Wiedemann, 1821.

Culex concolor, Robineau-Desvoidy, 1825.
Lutzia fuscana (Wiedemann) of Chung and Lin, 1929.

Localities: CHEKIANG - Chinhua, Hangchow, Huchow, Hwangyen.
FUKIEN - Changchow, Amoy, Foochow, Yungchun.
HUPEH - Wuhan area.
KIANGSI - Kiukiang.
KIANGSU - Shanghai.
KWANGTUNG - Canton, Swatow, Hongkong.

Distribution: Widespread in the Oriental region.

The breeding habits of this species are similar to those of Culex quinquefasciatus. The larvae are predaceous and feed not only on other mosquito larvae but also upon themselves. They have also been observed in comparatively clear water in association with the larvae of Aedes albopictus. Adults have seldom been observed inside dwellings but are known to attack man. Hu (1938) observed the development of infective Wuchereria bancrofti larvae in 69 of 75 experimentally infected specimens. Because the development of the infective larvae was somewhat abnormal, some doubt was expressed as to the potential role of fuscanus in the transmission of filariasis.

49. Culex (Lutzia) vorax Edwards, 1921.

Localities: ANHWEI - Hwangshan.
CHEKIANG - Hangchow, Huchow, Chuchi, Tientaishan, Hwangyen, Tienmushan, Yentangshan.
HOPEI - Peiping.
KIANGSI - Kiukiang.
KIANGSU - Shanghai, Nanking.
KWANGTUNG - Swatow, Hongkong.
SHANTUNG - Tsinan, Weihsien, Taian.

Distribution: India, Burma, China.

In north China, the larvae of this species are found in habitats similar to those of Culex fuscanus in central and south China. These habitats include various water containers, sewage canals, etc. The larvae of vorax are frequently associated with the larvae of pipiens pallens. Experimentally the adults have been found to attack man but have not been observed to do so under natural conditions. Hu (1941) observed the development of Wuchereria malayi larvae to the infective stage in this species Because of the small number of infective larvae observed, it is not concluded that this species is an important vector of filariasis.

50. Culex (Barraudius) modestus Ficalbi, 1890.

Localities: HOPEI - Peiping.
LIAONING - Mukden, Hailung.

Distribution: India, China.

The larvae of this species have been collected in ponds in Hailung and in pools and water containers along the streets of Peiping. It is a comparatively rare species and apparently nothing has been recorded concerning the habits of the adults.

51. Culex (Neoculex) brevipalpis (Giles), 1902.

Stegomyia brevipalpis Giles, 1902.

Localities: CHEKIANG - Hangchow.
FUKIEN - Foochow.
KWANGTUNG - Canton.

Distribution: Throughout the Oriental region.

The larvae have been found in tree holes; the habits of the adults are unknown.

52. Culex (Neoculex) hayashii Yamada, 1917.

Culex (Culex) hayashii Yamada, 1917.

Localities: ANHWEI - Hwangshan.
CHEKIANG - Mokanshan (Wuk'ang), Hwangyen, Yentangshan, Tientaishan, Hangchow.
HOPEI - Peiping.
KIANGSI - Kiukiang.
LIAONING - Mukden.
SHANTUNG - Taishan, Linchü.

Distribution: China, Japan.

The larvae seem to prefer pools, slowly flowing streams, swamps, etc.

53. Culex (Neoculex) sumatranus Brug, 1931.

Localities: KWANGTUNG - Hongkong.

Distribution: Sumatra, China.

The larvae are thought probably to occur in pools connected with hill country streams. Information has not been recorded on the habits of the adults.

54. Culex (Mochthogenes) castrensis var. foliatus Brug, 1932.

Localities: FUKIEN - Kushan (Foochow).
KWANGTUNG - Hongkong.

Distribution: China, Java.

Larvae have been taken in pools in sandy stream beds. The habits of the adults have not been recorded.

55. Culex (Mochthogenes) malayi (Leicester), 1908.

Aedes malayi Leicester, 1908.
Micraedes malayi (Leicester), 1908.

Localities: ANHWEI - Hwangshan.
CHEKIANG - Chinhua, Fuyang, Hangchow, Chuchi, Haimen, Chienteh, Hwangyen, Tienmushan, Tientaishan, Yentangshan.
FUKIEN - Foochow.
KIANGSI - Kiukiang.
KWANGTUNG - Hongkong.

Distribution: Throughout the Oriental region.

The larvae have been found in ponds and ditches with clear stagnant water. No information has been recorded concerning the habits of the adults.

56 Culex (Lophoceratomyia) infantulus Edwards, 1922.

Localities: ANHWEI - Hwangshan.
CHEKIANG - Chinhwa, Mokanshan (Wuk'ang), Fuyang, Tientaishan, Tienmushan, Yentangshan, Hangchow.
KIANGSI - Kiukiang.
KWANGTUNG - Hongkong.

Distribution: Thailand, China.

Larvae have been collected in rain pools, shaded pools connected with streams, irrigation ditches, etc. The habits of the adults have not been recorded.

57. Culex (Lophoceratomyia) minutissimus (Theobald), 1907.

Culiciomyia minutissimus Theobald, 1907.
Culex (Lophoceratomyia) minutissimus (Theobald), of Feng 1938.

Localities: KWANGTUNG - Hongkong.

Distribution: India, China, Indochina, Lesser Soenda, Celebes.

The breeding habits of this species are not known in China; elsewhere the larvae have been collected from rock springs, pools in rivers and river beds, coconut shells, shallow wells, stagnant water in shaded culverts, etc. The habits of the adults apparently have not been recorded.

58. Culex (Lophoceratomyia) rubithoracis Leicester, 1908.

Localities: CHEKIANG - Hangchow.
KWANGTUNG - Hongkong.

Distribution: India, Burma, Thailand, China, Malaya, Fórmosa, Borneo.

The habits of this species apparently have not been recorded.

59. Culex (Culiciomyia) pallidothorax Theobald, 1905.

Localities: CHEKIANG - Hangchow, Mokanshan (Wuk'ang), Huchow, Pingyang, Tienmushan, Yentangshan.
FUKIEN - Foochow, Amoy.
KWANGTUNG - Hongkong.

Distribution: India, Burma, Thailand, Indochina, China, Malaya, Celebes, Formosa.

The larvae of this species have been recorded from a variety of habitats including artificial containers, shady pools, stone holes, etc. They seem to prefer clean water although they have been taken also from contaminated water. Although the adults of this species are common around dwellings, they have only rarely been observed within dwellings and do not attack man.

60. Culex (Culiciomyia) shebbearei Barraud, 1924.

Localities: ANHWEI - Hwangshan.
CHEKIANG - Yentangshan, Hwangyen, Hangchow.
KWANGTUNG - Kowloon, Hongkong.

Distribution: India, China, Burma.

Larvae have been found in bamboo stumps and are thought to occur also in tree holes. The habits of the adults are unknown.

61. Culex (Culex) bitaeniorhynchus Giles, 1901.

Taeniorhynchus ager Giles, 1901.
Taeniorhynchus tenax Theobald, 1901.
Taeniorhynchus tenax var. ocellata Theobald, 1907.

Localities: ANHWEI - Hwangshan.
CHEKIANG - Chinhwa, Hangchow, Mokanshan (Wuk'ang), Chuchi, Fuyang, Hwangyen, Iwu, Chienteh, Lanchi, Pingyang, Tunglu, Yentangshan, Tientaishan, Tienmushan.
FUKIEN - Changchow, Amoy, Foochow, Yungchun.
HOPEI - Peiping.
HUPEH - Wuhan area.
KIANGSI - Kiukiang.
KIANGSU - Shanghai, Nanking.
KWANGTUNG - Canton, Swatow, Hongkong, Hainan.
LIAONING - Mukden.
SHANTUNG - Taishan, Linchü.

Distribution: Throughout the Oriental region, also Australia, Africa.

The larvae are found most frequently in fresh and clean natural water such as in hill country streams, pools, ditches, and especially in water with filamentous green algae. The larvae are usually found on the surface of the algae and when disturbed hide among the algae. They are frequently greenish in color. The female sucks blood usually at night but sometimes also during the day. When this species is abundant, it may be of some importance as a domestic pest. Hu (1939) was able to obtain experimental infections with Wuchereria bancrofti in this species. Since only one of 33 experimental infections developed infective larvae, this species is not regarded as a normal intermediate host of Wuchereria bancrofti. Esaki (1932) in Japan and Prawirohardjo (1939) in Java were unable to obtain experimental infections in bitaeniorhynchus with Wuchereria bancrofti.

62. Culex (Culex) fuscocephalus Theobald, 1907.

Localities: FUKIEN - Foochow.
KIANGSU - Shanghai.
KWANGTUNG - Canton, Hongkong.

Distribution: Probably throughout the Oriental region although not recorded as yet from Formosa.

Larvae have been taken from a shady pool, a mud hole, a pool contaminated with sewage, a barrel of water, and ponds. Adults have been captured in dwellings and are thought to be anthropophilic. In the Netherlands Indies this species has been found capable of developing infective bancrofti larvae although it is not generally regarded as a vector of importance.

63. Culex (Culex) gelidus Theobald, 1901.

Leucomyia gelidus Theobald , 1901.

Localities: KWANGTUNG - Canton, Hongkong.

Distribution: Throughout the Oriental region.

The larvae have been taken from pools with sandy bottoms and containing considerable decayed vegetable matter. The adults have been observed to be vigorous biters especially in the early part of the evening. Attempts to obtain infective Wuchereria bancrofti larvae in this species in Java have been unsuccessful.

64. Culex (Culex) jacksoni Edwards, 1934.

Localities: KWANGTUNG - Hongkong.

Distribution: Known only from China.

Information apparently has not been recorded concerning the habits of this species.

65. Culex (Culex) mimeticus Noé, 1899.

Localities: ANHWEI - Hwangshan.
CHEKIANG - Chinhwa, Hangchow, Mokanshan (Wuk'ang), Huchow, Hwangyen, Tienmushan, Yentangshan.
HOPEI - Peiping.
KIANGSI - Kiukiang.
KIANGSU - Shanghai, Nanking.
KWANGTUNG - Canton, Hongkong, Hainan.
SHANTUNG - Taishan, Linchü.
TIBET - Chumbi Valley, Yatung.

Distribution: India, Burma, Thailand, China, Indochina, Formosa, Malaya.

Larvae have been taken from pools or slowly running streams with green algae. There are a few records also from clear water in containers near dwellings. Adults have been observed only infrequently in dwellings.

66. Culex (Culex) mimulus Edwards, 1915.

Localities: HUNAN - Shaoyang, Pingkiang.
KWANGTUNG - Hongkong.

Distribution: India, Burma, Indochina, China, Malaya, Greater Soenda, Lesser Soenda.

No information has been recorded concerning the habits of this species.

67. Culex (Culex) orientalis Edwards, 1921.

Localities: CHEKIANG - Hangchow.
KWANGTUNG - Hongkong.
LIAONING - Mukden.

Distribution: Known only from China.

The larvae of this species were collected from a lake near Mukden with much surface vegetation and in ponds near Hangchow. No information has been recorded concerning the habits of the adults.

68. Culex (Culex) pipiens pallens Coquillett, 1898.

Culex pipiens Linnaeus, 1758, of various authors.
Culex (Culex) pipiens var. pallens Coquillett, 1898.

Localities: ANHWEI - Hwangshan.
CHEKIANG - Hangchow, Huchow, Kashing.
HOPEI - Peiping, Tientsin.
HUPEH - Wuhan area.
KIANGSU - Shanghai, Nanking, Tsingkiangpu, Hsüchowfu.
KIRIN - Kirin, Changchun.
LIAONING - Mukden, Hailung.
SHANTUNG - Tsinan, Tsingtao, Linchü, Taian.

Distribution: Japan, China.

This mosquito breeds in almost any collection of water but especially in those containing considerable organic matter. The females are strongly anthropophilic. Esaki (1932) has described pallens as a very suitable intermediate host of Wuchereria bancrofti in Japan. Hu and Yen (1933) found that 55 percent of the experimentally infected specimens developed infective bancrofti larvae. Hu and Chang (1938) demonstrated a high natural rate (17 percent); in specimens collected around the dwellings of filariasis cases, many had infective larvae.

69. Culex quinquefasciatus, Say, 1823.

Culex (Culex) fatigans Wiedemann, 1828.
Culex fouchowensis, Theobald, 1901.
Culex reesii Theobald, 1901.
Culex sericeus Theobald, 1901.

Localities: CHEKIANG - Chinhwa, Hangchow, Shaohyling, Fuyang, Haimen, Yuyao, Iwu, Pingyang, Hwangyen, Yentangshan, Tienmushan, Tientaishan.
FUKIEN - Changchow, Foochow, Amoy.
HUNAN - Shaoyang, Pingkiang.
KIANGSI - Kiukiang.
KIANGSU - Shanghai.
KWANGTUNG - Canton, Swatow, Hongkong, Hainan Island.
SZECHWAN - Chengtu.
YUNNAN - Kunming.

Distribution: Cosmopolitan in tropic and subtropic regions. In China this species extends as far northward as the line through central Szechwan and central Kiangsu Provinces. North of this line it is replaced by Culex pipiens pallens.

The larvae are found in small collections of water especially those with some organic matter. The adults are common domestic mosquitoes and are strongly anthropophilic. The role of this species in the transmission of filariasis perhaps has been exaggerated in some instances. Nevertheless, there is definite evidence that in some regions in China it may be a vector of some importance. Yokogawa, et al (1939) has suggested that it is the vector of filariasis in the Pescadores Islands. Brug (1938) observed complete development of infective bancrofti larvae in this species following artificial infection (Kabaena Island, near Celebes). However, the rate of natural infection was found to be extremely low (0.5 percent). Prawirohardjo (1939) in Java on the basis of experimental infections concluded that quinquefasciatus was a good vector of Wuchereria bancrofti. Galliard (1937) has regarded this species as a vector of filariasis in Indochina. Jackson (1935) has observed developing filarial larvae in quinquefasciatus in Hongkong. Hu (1935) found that 70 percent of the experimentally infected specimens developed infective bancrofti larvae.

70. Culex (Culex) sinensis Theobald, 1903.

Culex gelidus var. sinensis, Theobald, 1903.
Leucomyia sinensis (Theobald), 1903.

Localities: CHEKIANG - Shaohyling.
FUKIEN - Foochow, Amoy, Yungchun.
HUPEH - Wuhan area.
KIANGSI - Kiukiang.
KWANGTUNG - Hongkong.

Distribution: Throughout the Oriental region.

The larvae are usually found in ponds or pools in the stream beds of hill country streams. The females attack man vigorously especially during the early part of the night. Frequently they are found inside dwellings in hilly regions of south China.

71. Culex (Culex) sitiens Wiedemann, 1828.

Localities: FUKIEN - Amoy.
KWANGTUNG - Canton, Hongkong.

Distribution: This is a coastal species throughout the Oriental region.

Larvae are found in brackish-water pools. The adults are common near the coast where they enter dwellings and bite man at night. Experiments in Japan and Java have failed to develop infective Wuchereria bancrofti larvae in this species.

72. Culex (Culex) tritaeniorhynchus Giles, 1901.

Culex biroi Theobald, 1905.
Culex annulus Theobald, 1901.
Culex sitiens Theobald, 1901, (nec Wiedemann).

Localities: ANHWEI - Hwangshan.
CHEKIANG - Chinhwa, Chuchi, Fuyang, Hwangyen, Iwu, Chienteh, Pingyang, Tunglu, Tienmushan, Tientaishan, Yentangshan, Hangchow, Mokanshan (Wuk'ang).
FUKIEN - Foochow, Amoy.
HOPEI - Peiping, Tientsin.
HUPEH - Wuhan area.
KIANGSI - Kiukiang.
KIANGSU - Shanghai, Nanking.
KIRIN - Kirin, Changchun.
LIAONING - Hailung.
KWANGTUNG - Canton, Swatow, Hongkong.
SHANTUNG - Tsinan, Taian.

Distribution: Throughout the Oriental region, also west Africa and Egypt.

The larvae have been found in ponds, pools, ditches, rice fields, and numerous other habitats. The adults bite man frequently during the night inside dwellings as well as in the open. Esaki (1932) described this species as a possible intermediate host of Wuchereria bancrofti. Hu (1935) found that only four out of ninety-seven experimental infections developed infective bancrofti larvae. ~~These observations were confirmed by Wu~~ Hu (1940) ~~who found~~ again reported that only 1.5 percent of ~~the experimentally infected~~ 133 specimens ~~to~~ developed infective larvae of Wuchereria malayi ~~Prawirohardjo (1939) concluded that tritaeniorhynchus is not a vector of filariasis in Java.~~ experimentally.

73. Culex (Culex) vagans Wiedemann, 1828.

Culex virgatipes Edwards, 1914.

Localities: CHEKIANG - Hangchow.
FUKIEN - Foochow.
HOPEI - Peiping.
KIANGSU - Shanghai.
KIRIN - Kirin.
KWANGTUNG - Canton, Hongkong.
LIAONING - Mukden.
SHANTUNG - Tsinan.

Distribution: India, China.

Larvae have been found in lakes and pools and also in pools in hill country streams with filamentous algae.

74. Culex (Culex) vishnui Theobald, 1901.

Culex pseudoinfula Theobald, 1911.

Localities: ANHWEI - Hwangshan.
CHEKIANG - Hangchow, Mokanshan (Wuk'ang), Huchow, Chuchi, Fuyang, Haimen, Iwu, Kienteh, Pingyang, Hwangyen, Tienmushan, Tientaishan, Yentangshan.
FUKIEN - Changchow, Yungchun, Amoy, Foochow.
HOPEI - Tientsin.
HUNAN - Shaoyang, Pingkiang.

KIANGSI - Kiukiang.
KIANGSU - Shanghai.
KWANGTUNG - Canton, Hongkong.
SHANTUNG - Tsinan.

Distribution: Throughout the Oriental region, New Guinea.

In China the habits of this species are similar to those of Culex tritaeniorhynchus. In the Netherlands Indies, Brug (1938) has observed the complete development of Wuchereria bancrofti larvae in this species following experimental infection. Naturally infected specimens were also observed. These observations have been partially confirmed by the experiments of Prawirohardjo (1939) in Java.

75. Culex (Culex) whitmorei (Giles), 1904.

Taeniorhynchus whitmorei Giles, 1904.
Leucomyia whitmorei Giles, 1904.
Leucomyia plegipennis Theobald, 1907.

Localities: CHEKIANG - Hangchow, Yentangshan.
FUKIEN - Amoy, Yungchun.
KIANGSI - Kiukiang.
KWANGTUNG - Canton, Hongkong.

Distribution: Throughout the Oriental region.

The habits of this species are similar to those of gelidus although it is more characteristically a species of the hill country. Esaki (1932) describes whitmorei as a suitable intermediate host of Wuchereria bancrofti. Brug (1938) was able to obtain infective bancrofti larvae following artificial infection but was unable to find naturally infected specimens (Kabaena Island, near Celebes).

HYPOTHETICAL LIST

1. Armigeres (Armigeres) malayi (Theobald), 1901.

Uranotaenia malayi Theobald, 1901.

This species was recorded by Jackson (1932) in Hongkong although later investigations have not confirmed this report.

2. Aedes (Stegomyia) albolineatus (Theobald), 1904.

Scutomyia albolineatus Theobald, 1904.

This species is widespread from India to the Solomon Islands; its occurrence in China is quite probable.

3. Culex (Lutzia) halifaxii Theobald, 1933.

This species has been reported from Malaya to Australia including the Philippines and south China. The south China records need confirmation.

The larvae of this species have been collected in a variety of habitats including tanks, drains, water barrels, swamps, frequently in association with the larvae of Culex quinquefasciatus.

4. Culex (Culex) theileri Theobald, 1903.

This species has a wide distribution from the Mediterranean region and Africa to Assam and Burma. It is possible that it may occur in southern China.

APPENDIX D

A CHECKLIST OF THE TABANIDAE OF CHINA

The following is the list compiled by Wu (1940) together with the notes on distribution as given by this author. Minor changes in nomenclature have been made according to Olsufiev (1937).

Chrysozona atrata (Szilady), 1926.
Haematopota atrata Szilady, 1926.
Canton.

Chrysozona lata (Ricardo), 1906.
Haematopota lata, 1906.
Yunnan, north China, India, Burma, Sumatra.

Chrysozona sinensis Ricardo, 1911.
Haematopota sinensis, 1911.
China.

Chrysozona yamadai Shiraki, 1932.
Manchuria.

Tabanus abscondens Walker, 1860.
North China, Burma, Tenasserim.

Tabanus agricola Wiedemann, 1828.
Hongkong, Afrique septentrionale.

Tabanus amaenus Walker, 1848.
Tabanus okadae, 1913.
Mongolia, Hongkong, Swatow, Foochow, Shanghai, Weihaiwei, Japan, Formosa.

Tabanus aurotestaceus Walker, 1854.
Shanghai, north China, Formosa, Tonkin.

Tabanus brunnitibiatus Stekhoven, 1926.
Hongkong.

Tabanus bucolicus Schiner, 1868.
Hongkong.

Tabanus budda Portschinsky, 1887.
Tabanus buddha Portschinsky, 1891.
Mongolia.

Tabanus chrysurus Loew, 1858.
Mongolia, Japan.

Tabanus confucius Macquart, 1855.
China.

Tabanus ditoeniatus Macquart, 1838.
Weihaiwei, Hongkong, Somali, Persia, Africa, Japan, India.

Tabanus erberi Brauer, 1880.
Tientsin.

Tabanus exoticus Ricardo, 1913.
Canton, Japan, Formosa.

Tabanus felderi van der Wulp, 1885.
Ningpo.

Tabanus flavimarginatus Stekhoven, 1926.
Hongkong.

Tabanus fulvimedius Walker, 1848.
North China, Yunnan, Nepal, India, Formosa, Burma.

Tabanus fulvus Meigen, 1820.
Chekiang, Yangtse River, Europe, Africa, Japan, Asia Minor.

Tabanus hoang Macquart, 1855.
China.

Tabanus hongkongensis Ricardo, 1916.
Hongkong.

Tabanus hybridus Wiedemann, 1828.
Hongkong, Macao, Burma, Sylhet, Borneo, Assam, Malaya, Perak, Kuala Lumpur, Sumatra.

Tabanus indianus Ricardo, 1911.
Foochow, Hongkong, India, Formosa.

Tabanus jucundus Walker, 1848.
Hongkong, India, Bombay, Ceylon.

Tabanus longibasalis Stekhoven, 1926.
Hongkong.

Tabanus lucifer Szilady, 1926.
China, Balu Mountain.

Tabanus macfarlanei Ricardo, 1916.
Central China, Hongkong.

Tabanus mandarinus Schiner, 1868.
Tientsin, Weihaiwei, Chinkiang, Yangtse River, Foochow, Shanghai, Hongkong, Japan, Formosa.

Tabanus mentitus Walker, 1848.
China.

Tabanus monotaeniatus (Bigot), 1848.
Atylotus monotaeniatus Bigot, 1848.
Yunnan, India, Burma.

Tabanus negativus Ricardo, 1911.
Hongkong, Formosa.

Tabanus orientalis Wiedemann, 1824.
Yunnan, India, Orient.

Tabanus orientis Walker, 1848.
Yunnan, India.

Tabanus petiolatus Szilady, 1926.
Central China.

Tabanus pulchriventris Portschinsky, 1887.
Mongolia.

Tabanus pusillus Macquart, 1838.
China.

Tabanus rubidus Wiedemann, 1821.
Hongkong, India, Java, Sumatra, Siam, Cochinchina, Annam.

Tabanus rufinotatus (Bigot), 1892.
Atylotus rufinotatus Bigot, 1892.
West China, Yunnan, Australia.

Tabanus rufiventris Fabricius, 1805.
Hongkong, India, Sumatra, Formosa, Java, Malaya, Burma, Japan.

Tabanus rufofrater Walker, 1850.
Tabanus tener Osten Sacken, 1876.
Peiping, U.S.A.

Tabanus sabulatorum Loew, 1874.
Tabanus lama Portschinsky, 1891.
Mongolia, Crimea, Caucasus, central Asia.

Tabanus shirakii (Enderlein), 1925.
Therioplectes shirakii Enderlein, 1925.
Northwest China.

Tabanus signifer Walker, 1856.
China.

Tabanus sinensis Szilady, 1926.
Hongkong.

Tabanus striatus Fabricus, 1794.
Tabanus sinicus Walker, 1848.
Tabanus tenens Walker, 1850.
Hongkong, India, Java, Batavia, Sumatra.

Tabanus takasagoensis Shiraki, 1918.
China, Japan, Formosa.

Tabanus tataricus Portschinsky, 1887.
Tientsin, Mt. Altai, central Asia, Turkestan, Usek, Siberia.

Tabanus tibetanus Szilady, 1926.
Tibet.

Tabanus yao Macquart, 1855.
North China, Weihaiwei, Shanghai, Japan.

Chrysops designata Ricardo, 1911.
Yunnan, west China, Nepal, India.

Chysops dispar (Fabricius), 1798.
Tabanus dispar Fabricius, 1798.
Canton, Swatow, Hongkong, India, Java, Borneo, Ceylon, Philippines, Bengal, Formosa, Thailand, Annam.

Chrysops dissectus Loew, 1858.
Mongolia.

Chrysops mlokosiewiczi Bigot, 1880.
Chusan, Amoy, Yunnan, Hongkong, Caucasus, Iran, Ussuri, Siberia, Japan, Formosa.

Chrysops mongolicus Szilady, 1926.
Mongolia.

Chrysops oxianus Pleske, 1910.
China, central Asia.

Chrysops potanini Pleske, 1910.
Central China, Szechwan, Japan.

Chrysops ricardoae Pleske, 1910.
Chrysops przewalskii Pleske, 1910.
Mongolia, Ordos.

Chrysops sinensis Walker, 1856.
Chekiang, Haining, Hankow, Swatow, Formosa.

Chrysops suavis Loew, 1858.
Siberia, Japan, Formosa.

APPENDIX E

THE CHINESE SPECIES OF FLEBOTOMUS

This list is based on the compilation of Wu (1941) and the papers of Yao and Wu (1941, 1941) with some additions and changes in nomenclature from various sources. In general the Flebotomus fauna of China is poorly known.

Flebotomus bailyi var. campester Sinton, 1931.
In China, reported only from Hainan Island (numerous localities); India, Thailand, Indochina.

Flebotomus barraudi Sinton, 1929.
Kiangsu: Nanking.
Yunnan: Tche-Souen.
Burma, India.

Flebotomus barraudi var. kwangsiensis Yao and Wu, 1940.
Kwangsi: Nanning, Tienpao.

Flebotomus chinensis Newstead, 1916.
Hopei: Peiping, Tunghsien, Tientsin.
Kiangsu: Hsuchow, Tsingkiangpu, Haichow, Lienshui, Szeyang.
Shantung: Taian, Tsinan.
India.

Flebotomus iyengari var. hainanensis Yao and Wu, 1938.
Hainan Island: Paoting and Lungshui.

Flebotomus kachekensis Yao and Wu, 1938.
Hainan Island: Kachek.

Flebotomus khawi Raynal, 1936.
Hopei: Peiping.

Flebotomus kiangsuensis Yao and Wu, 1938.
Kiangsu: Tsingkiangpu, Hwaian, Yangchow.

Flebotomus pooi Yao and Wu, 1940.
Kwangsi: Tienpao.

Flebotomus major Annadale, 1910.
North China, Europe, central Asia.

Flebotomus sergenti var. mongolensis Sinton, 1928.
Chekiang: Wuhing.
Hopei: Peiping, Tunghsien, Tientsin.
Kiangsu: Hsuchow, Tsingkiangpu, Lienshui, Szeyang, Hwaian.
Shantung: Taian, Tsinan.

Flebotomus squamipleuris Newstead, 1912.
Hainan Island: Paoting, Lingshui.
Africa, India, Thailand, central Asia.

Flebotomus squamirostris Newstead, 1923.
Hopei: Peiping, Tunghsien, Tientsin.
Kiangsu: Tsingkiangpu, Yangchow, Nanking.
Shantung: Taian, Tsinan.
Japan.

Flebotomus stantoni Newstead, 1914.
Hainan Island: Paoting, Aihsien.

APPENDIX F.

A LIST OF THE FLEAS OF CHINA.

This list has been compiled from the two extensive treatises of Liu (1936, 1939). The nomenclature is that accepted by this author; the synonyms included are only those which have been referred to Chinese material. For taxonomic work on Chinese fleas it is recommended that the keys in Liu's latter monograph (1939) be used. This paper contains detailed descriptions and illustrations. The hosts are cited in accordance with Liu with no changes in nomenclature. Unless otherwise stated the host records refer to China only. Data are unavailable for a few of the species.

Diamanus mandarinus (Jordan and Rothschild), 1911.
Ceratophyllus mandarinus Jordan and Rothschild, 1911.
Host: Citellus dahuricus mongolicus.
Records: Shensi (Yu-lin-fu).

Diamanus montanus montanus (Baker), 1895.

Amphalius runatus (Jordan and Rothschild), 1923.
Ceratophyllus runatus Jordan and Rothschild, 1923.
Host: Ochotona dahurica, Ochotona alpina.
Records: Manchuria, Mongolia (Urga), Transbaikalia.

Amphalius clarus (Jordan and Rothschild), 1922.
Ceratophyllus clarus (Jordan and Rothschild), 1922.
Host: Ochotona curzoniae.
Records: Tibet (Tingri).

Oropsylla silantiewi silantiewi (Wagner), 1898.
Ceratophyllus silantiewi Wagner, 1898.
Host: Marmota bobac.
Records: Manchuria. Europe, Himalaya.

Oropsylla silantiewi crassus (Jordan and Rothschild), 1911.
Ceratophyllus crassus Jordan and Rothschild, 1911.
Host: Marmota robusta.
Records: Kansu (Old Tau-chow).

Oropsylla elana Jordan, 1929.
Host: Citellus mongolicus (?), Cricetulus campbelli.
Records: Manchuria (Bank of Sungari River opposite Harbin and Anda Steppe near Harbin).

Ceratophyllus (Citellophilus) tesquorum mongolicus Jordan and Rothschild, 1911.
Ceratophyllus mongolicus Jordan and Rothschild, 1911.
Citellophilus tesquorum mongolicus Jordan and Rothschild, 1911.
Host: Citellus dahuricus mongolicus.
Records: Shensi (Yu-lin-fu), Mongolia. East Siberia (on Urocitellus eversmanni).

Ceratophyllus (Citellophilus) tesquorum sungaris Jordan, 1929.
Citellophilus tesquorum sungaris (Jordan), 1929.
Host: Cricentulus arenarius, Citellus mongolicus (?).
Records: Manchuria (Ta-lin, Chendjatien, Tungliao, and Sungari River opposite Harbin).

Ceratophyllus (Citellophilus) tesquorum famulus Jordan and Rothschild, 1911.

Ceratophyllus (Callopsylla) dolabris Jordan and Rothschild, 1911.
Citellophilus dolabris (Jordan and Rothschild), 1911.
Host: Marmota robusta.
Records: Kansu (Old Tau-chow).

Ceratophyllus (Callopsylla) kozlovi Wagner, 1929.
Callopsylla kozlovi (Wagner), 1929.
Host: Microtus sp.
Records: East Tibet (Huan-che River).

Ceratophyllus (Callopsylla) kaznakovi Wagner, 1929.
Host: Putorius sp., Mustela sp.
Records: East Tibet (I-tchu River, Dza-tchu River, Kam).

Ceratophyllus (Ceratophyllus) sinicus Jordan, 1932.
Host: Ochotona cansa.
Records: Szechwan (Wu-chi).

Ceratophyllus (Ceratophyllus) gallinae (Shrank), 1803.

Ceratophyllus (?) phaeopsis Jordan and Rothschild, 1911.
Host: Sciurotamias davidianus consobrinus.
Records: Szechwan (southeast Ta-tsien-lu).

Ceratophyllus (?) sparsalis Jordan and Rothschild, 1922.
Host: Ochotoma curzoniae.
Records: Tibet (Tingri).

Aceratophyllus euteles (Jordan and Rothschild), 1911.
Ceratophyllus euteles Jordan and Rothschild, 1911.
Host: Several species of wild rodents.
Records: Szechwan (Ta-tsien-lu, Mi-hola, Mu-li, Wu-chi, Omi-shan to Liang-fing-kang), Yunnan (Yunning).

Neoceratophyllus trispinosus Liu, 1939.
Host: Sciurus sp.
Records: Chekiang (Tien Mo Shan).

Ceratophyllus (Nosopsyllus) fasciatus Bosc, 1801.
Nosopsyllus fasciatus (Bosc), 1801.
Cosmopolitan on various species of Rattus, Mus, and other rodents.

Ceratophyllus (Gerbillophilus) laeviceps laeviceps Wagner, 1929.
Nosopsyllus (Gerbillophilus) laeviceps (Wagner), 1929.
Southern and eastern USSR, Caucasus, Transcaspia, West Turkestan on Gerbillinae.

Ceratophyllus (Gerbillophilus) laeviceps ellobii (Wagner), 1933.
Nosopsyllus laeviceps ellobii Wagner, 1933.
Ceratophyllus laeviceps mongolicus Wagner, 1929.
Host: Ellobius tancrei.
Records: Mongolia.

Ceratophyllus (Monopsyllus) anisus Rothschild, 1908.
Monopsylla anisus (Rothschild), 1908.
Host: Rattus.
Records: Peiping, Hsuchowfu, Manchuria. Japan, North America.

Paraceras crispus (Jordan and Rothschild), 1911.
Ceratophyllus crispus Jordan and Rothschild, 1911.
Host: Sciurotamias davidianus.
Records: Szechwan (Ta-tsien-lu and Omi-shan).

Paraceras sinensis (Liu), 1935.
  Oropsylla sinensis Liu, 1935.
  Host: (?) Wild mammal.
  Records: Szechwan (Suifu).

Ophthalmopsylla praefectus pernix Jordan, 1929.
  Host: Alactaga mongolica, Ochotona dahurica.
  Records: Mongolia (Sungei Valley near Urga).

Ophthalmopsylla kukuschkini Ioff, 1927.
  Host: Cricetulus griseus fumatus.
  Records: South Manchuria (sand dunes near Chendjatien). Transbaikalia on Citellus dahuricus.

Ophthalmopsylla jettmari Jordan, 1929.
  Host: Cricetulus spp.
  Records: South Manchuria (sand dunes near Chendjatien).

Ophthalmopsylla kiritschenkoi Wagner, 1929.
  Host: Unknown rodent.
  Records: Mongolia.

Paradoxopsyllus curvispinus Miyajima and Koidzumi, 1909.
  Ceratophyllus curvispinus Miyajima and Koidzumi, 1909.
  Host: Mus confucianus luticolor.
  Records: Shensi (Yen-an-fu), Japan, Turkestan.

Paradoxopsyllus custodis Jordan, 1932.
  Host: Anteliomys custos.
  Records: Szechwan (Mu-li, Wu-chi).

Paradoxopsyllus conveniens Wagner, 1929.
  Host: Ellobius tancrei.
  Records: Mongolia.

Geosibia torosa Jordan, 1932.
  Host: Ochotona cansa.
  Records: Szechwan (Wu-chi).

Frontopsylla elatus botis Jordan, 1929.
  Host: Rats.
  Records: South Manchuria (Charithun near Nungkiang).

Frontopsylla luculenta luculenta (Jordan and Rothschild), 1923.
  Ceratophyllus luculentus Jordan and Rothschild, 1923.
  Host: Ochotona dahurica.
  Records: Manchuria, Transbaikalia.

Frontopsylla luculenta parilis Jordan, 1929.
  Host: Various species of rodents.
  Records: Mongolia (Sungei Valley near Urga).

Frontopsylla wagneri Ioff, 1927.
  Host: Ochotona dahurica.
  Records: Mongolia (Urga).

Frontopsylla hetera Wagner, 1932.
  Host: Ellobius tancrei.
  Records: Mongolia (Hangai River).

Frontopsylla spadix spadix (Jordan and Rothschild), 1921.
  Ceratophyllus spadix Jordan and Rothschild, 1921.
  Host: Apodemus silvaticus latorum.
  Records: Yunnan (Nguluko). Burma.

Frontopsylla spadix cansa Jordan, 1932.
Host: Ochotona thibetana, Ochotona cansa.
Records: Szechwan (Ku-lu, Wu-chi).

Amphipsylla tuta Wagner, 1929.
Host: Microtus sp.
Records: Tibet.

Amphipsylla aspalacis Jordan, 1929.
Host: Myotalpa aspalax (?).
Records: Manchuria (Sansin, Lahassu).

Amphipsylla casis Jordan and Rothschild, 1911.
Host: Myospalax fontanieri.
Records: Shensi (Yu-lin-fu).

Amphipsylla mitis Jordan, 1929.
Amphipsylla primaris botis Jordan, 1929.
Host: Microtus economus.
Records: Mongolia (Urga), Transbaikalia.

Amphipsylla vinogradovi Ioff, 1927.
Host: Cricetulus furunculus.
Records: Manchuria (Sansin), Transbaikalia.

Neopsylla bidentatiformis (Wagner), 1933.
Typhlopsylla bidentatiformis Wagner, 1933.
Host: Many species of wild rodents.
Records: Manchuria. Crimea.

Neopsylla anoma Rothschild, 1912.
Host: Myospalax consus.
Records: Shensi (Yu-lin-fu).

Neopsylla aliena Jordan and Rothschild, 1911.
Host: Myospalax fontanieri.
Records: Shensi (Yu-lin-fu).

Neopsylla compar Jordan and Rothschild, 1911.
Host: Dignus sowerbyi.
Records: Shensi (Yu-lin-fu).

Neopsylla stevensi Rothschild, 1915.
Host: Rattus griseipectus, Anteliomys custos.
Records: Szechwan (Mu-li, I-tze). Nepal-sikkim frontier on Epimys fulvescens.

Neopsylla specialis Jordan, 1932.
Host: Apodemus agrarius.
Records: Yunnan (Nguluko, Yung-ning).

Neopsylla honora Jordan, 1932.
Host: Eothenomys proditor.
Records: Yunnan (Nguluko).

Stenoponia coelestis Jordan and Rothschild, 1911.
Host: Sciurotamias davidianus.
Records: Szechwan (Ta-tsien-lu).

Palaeopsylla remota Jordan, 1929.
Host: Mole.
Records: Szechwan (Chungking).

Ctenopsyllus segnis (Schönherr), 1811.
Pulex segnis Schönherr, 1811.
Pulex musculi Dugès, 1832.
Leptopsylla musculi (Dugès), 1832.
Host: Rats, mice.
Records: Canton, Shanghai, Hangchow. Cosmopolitan.

Pectinoctenus adalis Jordan, 1929.
Host: Rat.
Records: Manchuria (Charithun near Nunkiang).

Ctenophthalmus parcus Jordan, 1932.
Host: Anteliomys custos.
Records: Szechwan (Wu-chi).

Ctenophthalmus yunnanus Jordan, 1932.
Host: Apodemus agrarius.
Records: Yunnan (Nguluko).

Ctenophthalmus dinormus Jordan, 1932.
Host: Anteliomys custos.
Records: Szechwan (Wu-chi).

Rectofrontia dahurica (Jordan and Rothschild), 1923.
Rhadinopsylla dahurica Jordan and Rothschild, 1923.
Host: Ochotona dahurica.
Records: Manchuria, Transbaikalia.

Rectofrontia tenella (Jordan), 1929.
Rhadinopsylla tenella Jordan, 1929.
Host: Cricetulus sp.
Records: Manchuria. (Chendjatien).

Rectofrontia dives (Jordan), 1929.
Rhadinopsylla dives Jordan, 1929.
Host: Cricetulus griseus, Citellus sp.
Records: South Manchuria (near Chendjatien and Ta-lin).

Rectofrontia jaonis (Jordan), 1929.
Rhadinopsylla jaonis Jordan, 1929.
Host: Scaptochirus gilliesi, Myotalpa aspalax.
Records: Shansi (Wu-yasi), Manchuria (Sansin).

Rectofrontia insolita (Jordan), 1929.
Rhadinopsylla insolita Jordan, 1929.
Host: Cricetulus sp.
Records: South Manchuria (near Chendjatien and Ta-lin).

Rectofrontia accola (Wagner), 1929.
Rhadinopsylla accola Wagner, 1929.
Host: Putorius sp.
Records: Tibet (D-dju River).

Rectofrontia vicina (Wagner), 1929.
Rhadinopsylla vicina Wagner, 1929.
Host: Putorius sp.
Records: Tibet (D-dju River).

Stenischia mirabilis Jordan, 1932.
Host: Anteliomys custos.
Records: Szechwan (Mu-li).

Ischnopsyllus comans Jordan and Rothschild, 1932.

Host: Vesperugo planeyi.
Records: Peking.

Ischnopsyllus needhamia Hsü, 1935.
Host: Several species of bats.
Records: Soochow.

Ischnopsyllus taeteishii Sugimoto, 1933.
Host: Common house bat.
Records: Hangchow. Formosa.

Myodopsylla trisellis Jordan, 1929.
Host: Pipistrellus.
Records: Manchuria (Charithun near Nunkiang).

Nycteridopsylla galba Dampf, 1910.
Ischnopsyllus wui Hsü, 1935.
Host: Bat.
Records: Shanghai, Soochow.

Chaetopsylla hangchowensis Liu, 1939.
Host: Putorius sinensis.
Records: Hangchow.

Vermipsylla doracadia Rothschild, 1912.
Host: Capreolus bedfordiae, Antilopa subguturosa.
Records: Shensi (Yen-an-fu).

Ctenocephalides canis (Curtis), 1826.
Pulex canis Curtis, 1826
Host: Many mammals, including dog, cat, sheep, man; also domestic fowl.
Records: Shanghai, Hangchow, Soochow, etc. Cosmopolitan.

Ctenocephalides felis (Bouché), 1835.
Pulex felis Bouché, 1835.
Host: Cats, dogs, other Carnivora, and man.
Records: Shanghai, Soochow, Hangchow, etc. Cosmopolitan.

Archaeopsylla sinensis Jordan and Rothschild, 1911.
Host: Erinaceus miodon.
Records: Shensi (Yu-lin-fu).

Xenopsylla cheopis (Rothschild), 1903.
Pulex cheopis Rothschild, 1903.
Loemopsylla cheopis (Rothschild), 1903.
Host: Various species of Rattus, occasionally man.
Records: Canton, Peiping, Hsuchowfu, Shanghai. Cosmopolitan.

Pulex irritans Linnaeus, 1758.
Host: Man, domestic mammals, other mammals.
Records: Cosmopolitan.

Dermatophilus caecigena (Jordan and Rothschild), 1921.
Tunga caecigena Jordan and Rothschild, 1921.
Host: Various species of rats.

Echidnophaga gallinacea (Westwood), 1875.
Sarcopsyllus gallinaceus Westwood, 1875.

APPENDIX G.

A LIST OF THE TICKS OF CHINA.

The following list is compiled from various sources. The host records are principally taken from Elishewitz' "Ticks of the Pacific Region", 1943, without change of nomenclature, and refer to other localities as well as to China.

Ixodes acutitarsus (Karsch, 1880) (= *I. gigas* Warburton, 1910)

Records: Tibet (Chamuteng).
Distribution: Japan, Formosa, Burma, India.
Hosts: Man, deer, cattle (*Bos taurus*), Indian buffalo (*Bos indicus*), pig (*Sus taivanus*).

Ixodes angulatus Kishida, 1941

Record: Jehol.

Ixodes autumnalis Leach, 1815

Records: Mongolia, Transbaikalia.
Distribution: Far Eastern Russia, Kazakstan.
Hosts: Dog, suslik (*Citellus* sp.) tarabagan (*Marmota bobac*, *M. caudata*), *Cotile riparia*.

Ixodes japonensis Neumann, 1904

Records: Yunnan, Tibet.
Distribution: Japan, Burma, India.
Hosts: Horse, cow, barking deer.

Ixodes nuttallianus Schulze, 1930 (= *I. ricinoides* Nuttall, 1913)

Schulze stated that this species is most probably a Chinese race of *persulcatus*.

Record: China.
Hosts: Swamp deer, musk deer.

Ixodes ricinus (Linnaeus, 1758)

Record: China.
Distribution: Cosmopolitan.
Hosts: Many mammals; nymphs also on birds.

Ixodes simplex Neumann, 1906

Record: Kiangsu (Shanghai).
Distribution: Gabon, South Africa.
Hosts: Horseshoe bat (*Rhinolophus ferrum-equinum*), frosted bat (*Vespertilio* sp.), little brown bat (*Myotis tricolor*).

Rhipicephalus carinatus Frauenfeld, 1867

Record: China Sea (collected on deck of ship).

Rhipicephalus haemaphysaloides Supino, 1897

Record: China.
Distribution: Oriental.
Hosts: Man, cattle, buffalo, wild pig, goat, dog, wolf.

Rhipicephalus haemaphysaloides expeditus Neumann, 1904

Record: China.
Distribution: Sumatra.
Host: Indian buffalo (Buffelus indicus).

Rhipicephalus sanguineus Latreille, 1806

Record: Eastern China.
Distribution: Cosmopolitan.
Hosts: Mainly dogs, also man, cattle, buffalo, camel, goat, sheep, donkey, hare, hedgehog, birds, turtle, etc.

Hyalomma aegyptium (Linnaeus, 1758)

Record: Mongolia.
Distribution: Palaearctic, also Africa, India, Java.
Hosts: Mainly cattle, also man, buffalo, camel, giraffe, sheep, goat, deer, horse, ass, mule, cat, dog.

Hyalomma detritum albipictum Schulze, 1919

Record: Manchuria.

Hyalomma detritum perstrigatum Schulze, 1930

Record: Hopei (Peiping).

Hyalomma kozlovi Olenev, 1931

Record: Mongolia.

Hyalomma verae Olenev, 1931

Record: Mongolia.
Host: Goitred or Persian gazelle (Gazella subgutturosa).

Amblyomma cyprium Koch and Neumann, 1899

Record: Borders of China Sea.
Distribution: Marianas Islands, Formosa, Malay Archipelago, Philippines.
Hosts: Cattle, water buffalo, Celebean pig (Sus celebensis), turtles (Chelonia spp.)

Amblyomma sublaeve Neumann, 1899

Record: Kwangtung (Canton).
Distribution: Siam, Malaya, India, East Indies Archipelago.
Hosts: Pangolin (Manis javanica, M. aurita, M. pentadactyla), snake (Python molurus vesperugo), turtle (Nicoria tricarinata).

Haemaphysalis birmaniae Supino, 1897

Record: China.
Distribution: Japan, Formosa, Burma, India, Sumatra, Borneo.
Hosts: Buffalo (Bubalus buffelus), Indian buffalo (Bos indicus), pig (Potamochoerus larvatus), goat (Capra hircus), muntjac (Cervulus muntjac), brown bear (Ursus torquatus), horse (Equus caballus), mouse, porcupines (Atherura macrura, Hystrix bengalensis), thar (Nemorhaedus bubalinus).

Haemaphysalis bispinosa Neumann, 1897

Records: Shantung (Tsingtao); Anhwei.
Distribution: Siberia, Japan, Formosa, Burma, India, Malay Archipelago, Australia, Africa.
Hosts: Man, black monkey, toque macaque (*Macacus sinicus*), dog, tiger, lions, polecats, goat, Nilgiri wild goat (*Hemitragus hylocrius*), Chinese river deer (*Hydropotes inermis*), sheep, cattle, wild red deer, mouse deer, barking deer (*Cervulus* sp.), rabbit (*Lepus europaeus*), goat antelope (*Naemorhaedes cinereus*), little civet (*Viverricula malaccensis*), mongoose, mole (*Talpa* sp.), rats, fowls, birds (*Turdus philomelus*, *Alauda arvensis*).

Haemaphysalis campanulata Warburton, 1908

Records: Shantung (Weihaiwei); Szechwan (Chengtu); Mongolia.
Distribution: Japan, India.
Hosts: Cattle, deer, horse, dog, wolf, house rat.

Haemaphysalis campanulata hoeppliana Schulze, 1931

Record: Hopei (Peiping).
Host: Dog.

Haemaphysalis hystricis Supino, 1897

Record: Shantung (Tsingtao).
Distribution: Formosa, Burma, Ceylon, Malay Archipelago.
Hosts: Pigs (*Sus celebensis*, *S. taiwanus*), Nias pig, brown bear (*Ursus torquatus*), Sambar deer (*Cervus unicolor swinhoei*), tiger, hog-nosed badger (*Arctomyx hoeveni*), porcupine (*Hystrix bengalensis*), hedgehog (*Erinaceus* sp.), turtle (*Geoemyda spinosa*).

Haemaphysalis japonica Warburton, 1908

Record: Kansu.
Distribution: Japan.
Host: Goral (*Nemorhaedus crispus*).

Haemaphysalis japonica douglasi Nuttall and Warburton, 1915

Record: Shensi (Ten-an-fu).
Distribution: Eastern Siberia.
Host: Sika deer (*Cervus hortulorum*).

Haemaphysalis neumanni Donitz, 1905

Record: China.
Distribution: Eastern Siberia, Japan, Ceylon.
Hosts: Dog (*Canis familiaris*), jackal (*Canis aureus*), horse, cattle.

Haemaphysalis warburtoni Nuttall, 1912

Record: Szechwan (Wen-chwan-hsien).
Distribution: Japan, Formosa, western Siberia, Altai Mountains.
Hosts: Serow, cattle.

Aponomma pseudolaeve Schulze, 1935

Records: Chekiang (Ningpo); Kwangtung (Swatow).
Hosts: Snakes (*Zamensis mucosus*, *Coluber phyllophis*).

Uroboophilus caudatus (Neumann, 1897)

Records: Chekiang (Mokanshan); Fukien.
Distribution: Japan.
Hosts: Dog, horse, cattle, water buffalo, Japanese deer, rabbit, poultry.

Uroboophilus distans Minning, 1934

Records: Fukien (Amoy); Hongkong.
Distribution: Formosa, Indo-China.
Hosts: Macaque, cattle, zebu, buffalo, mountain goat, swine.

Uroboophilus sinensis Minning, 1934

Records: Shantung (Tsingtao); Kiangsu (Shanghai); Fukien (Amoy).
Distribution: Japan, Formosa.
Hosts: Dog, cattle, buffalo, mountain goat, horse.

Dermacentor birulai Olenev, 1929

Record: Eastern Tibet.

Dermacentor everestianus Hirst, 1926

Record: Tibet (Tinki Dzong).

Dermacentor nuttalli Olenev, 1929

Records: Mongolia, Transbaikalia.
Distribution: Eastern Siberia.
Hosts: Horse, swine.

Dermacentor reticulatus (Fabricius, 1794)

Record: Manchuria.
Distribution: Palaearctic.
Hosts: Man, cattle, camel, deer, goat, swine, horse, bat (Miniopterus schreibersi), Rhinoceros bicornis, Hippopotamus amphibius.

Dermacentor sinicus Schulze, 1931

Record: Hopei (Peiping).
Host: Hedgehog.

Dermacentor sinicus pallidior Schulze, 1931

Record: Shantung (Tsingtao).
Host: Hedgehog.

Argas persicus Oken, 1818

Record: Hopei (Peiping).
Distribution: Cosmopolitan.
Hosts: Man, cattle, fowls, duck, goose, turkey, ostrich, canaries, wild birds.

APPENDIX H.

A LIST OF THE POISONOUS SNAKES OF CHINA.

The following list has been compiled from Pope (1935) and is restricted to poisonous species. This author lists a total of 130 species and subspecies of snakes known to occur in China. These belong to 46 genera and nine families. The localities given are those recorded by Pope.

Family Elapidae

Bungarus fasciatus (Schneider), 1801.
Fukien.
Kwangtung: Tinghushan, Canton and region, Wuyung, Namkong, Lofaoshan, Fumun, Lilong, mainland opposite Hongkong.
Kwangsi: Lohsiang.
Yunnan: Kutung, Hokow.

Bungarus multicinctus multicinctus Blyth, 1861.
Universally distributed in southeastern China.
Chekiang.
Kiangsi: Lushan.
Hunan: Yochow, Shenchow.
Hupeh: Ichang.
Kwangsi: Yaoshan.
Kwangtung: Hainan Island.

Bungarus multicinctus wanghaotingi Pope, 1928.
Yunnan: Yuankiang.

Calliophis macclellandi (Reinhardt), 1844.
Kiangsi: Lushan, Pingsiang.
Fukien: Chungan.
Kwangtung: Northern Kwangtung.
Hainan: Kachek, Nodoa.
Kwangsi: Lohsiang.

Hemibungarus kelloggi Pope, 1928.
Fukien: Chungan (including Kuatun), Yenping, Futsing.
Kwangsi: Lohsiang.

Naja hannah (Cantor), 1836.
Fukien: Kuliang-kushan mountains (near Foochow).
Kwangtung: Tsingyun, Tsungfa, Wuyung, Namkong, Lofaoshan, probably Hainan Island.
Kwangsi: Lohsiang.

Naja naja atra Cantor, 1842.
Hunan: Southwestern Hunan.
Kiangsi: Kiukiang, Hokow.
Chekiang: Chushan Island, vicinity of Sihu, Tunglu, Taichow, Wenchow.
Fukien: Ningteh, Pagoda Anchorage, Foochow, Futsing, Yenping, Chungan.
Kwangtung: Lamock Island, Canton, Chukiang.
Hainan: Hoihow, Nodoa.
Kwangsi: Lohsiang.

Family Viperidae

Azemiops feae Boulanger, 1888.
Szechwan: Yenchinghsi, Chouchiakou.

Kiangsi: Pingsiang.

Vipera russelii siamensis Smith, 1917.
Kwangtung: Wuyung, Namkong.

Family Crotalidae

Agkistrodon acutus (Guenther), 1888.
Hupeh: Ichang, Wusüeh.
Hunan: Shenchow.
Chekiang: Mokanshan.
Fukien: Chungan (including Kuatun).
Kwangtung: Near the Hunan boundary.

Agkistrodon halys (Pallas), 1776.
Kiangsu: Shanghai and vicinity, vicinity of Kunshan, Soochow, Wusih, Kiangyin, Chinkiang, Nanking.
Chekiang: Ningpo, Talanshan, Hangchow, Tunglu.
Anhwei: Wangwanshan, Ningkwo, Chiuhuashan, Tatung, Chungmingchieh, Chuchow and vicinity.
Kiangsi: Kiukiang and vicinity, Lushan including Kuling, Pingsiang.
Hupeh: Hankow, Ichang, Kweichow.
Hunan: Siangtan, Yohlushan, Changsha, Yochow, Shenchow.
Szechwan: Wanhsien, "Tchi-Gô", Kwanhsien.
Hopei: Peiping and vicinity--Tungling, Jade Fountain, Hsiling.
South Manchuria: Hsiaolungshantao (a small island beyond the tip of Liaotung Peninsula) (Koba 1938).

Agkistrodon monticola Werner, 1922.
Yunnan: Mountains north and slightly west of Likiang.

Agkistrodon strauchi Bedriaga, 1912.
Sikang: Upper Yangtze, Yamala, Tungngolo, Yinkuanchai, Tatsienlu, Yulunghsi, Anyangpa.
Szechwan: Sungpan.

Trimeresurus albolabris Gray, 1842.
Fukien: Futsing, Kuliang, Yenping, Chungan City.
Kwangtung: Shiuhing, Tinghushan, Szewui, Namkong, Lofaoshan, Lilong, Linping, Chonglok.
Hainan: Hoihow, Tingan, Kachek, Nodoa, Wuchih mountains.
Kwangsi: Lohsiang, Chinhsiu.

Trimeresurus jerdonii Guenther, 1875.
Yunnan: Between Yungping and Yungpeh, between Chao and Hsiaotsun, Yunnanfu, Tungchwan.
Szechwan: Yaochi near Muping, Yachow and Yachow Prefecture, Kiating, Mt. Omei, Washan, Süchow.
Hupeh: Ichang.

Trimeresurus monticola Guenther, 1864.
Yunnan: Outskirts of Husa, Tali region.
Szechwan: Lungan, Kiating, Hualienszu, Mt. Omei, Chouchiakou, Yunnan border south of Suchow.
Chekiang.
Fukien: Chungan, Shaowu.

Trimeresurus mucrosquamatus (Cantor, 1839).
Fukien: Yenping, Futsing, hills north of Yungchun.
Kwangtung: Mountains of north, Lungton.
Kwangsi: Lohsiang, Chinhsiu, Kuchen.
Szechwan: Yenchingkou, Chungking, Hsiaomienhsi, Hochuan, Süchow, Chouchiakou, Hsinchang, Yenchinghsi, Wenchwan.

Trimeresurus stejnegeri stejnegeri Schmidt, 1925.

Kwangsi:	Kuchen.
Kwangtung:	Mountains of north near the Hunan and Kiangsi boundaries, including Wanszushan; Hainan Island.
Hunan:	Taolin.
Fukien:	Futsing, Yenping, Shaowu, Chungan hsien (including Kuatun).
Chekiang:	Tunglu, Ningpo region, Mokanshan.

Trimeresurus stejnegeri yunnanensis Schmidt, 1925.

Yunnan:	Yunnanfu, Luchuan, Tali, Tengyueh.

APPENDIX I

RESULTS OF EXAMINATIONS
FOR
INTESTINAL PARASITES

TABLE I. - INTESTINAL NEMATODES, RESULTS OF FECAL EXAMINATION MADE IN DIFFERENT PARTS OF CHINA.

Locality	Composition of Population	Total No. Examined	Average No. of Examination Per Person	Incidence in Percentage								Investigator and Date
				Ascaris lumbricoides	Ancylostoma and Necator	Ancylostoma duodenale	Necator americana	Trichuris trichiura	Strongyloides stercoralis	Enterobius vermicularis	Trichostrongylus orientalis	
Pinchiang		220		19.1	0.5			2.3				Lin ~~Swee~~ & Wu, 1927
Pinchiang		350		19.7	5.1			4.6		0.3	0.8	
Peiping	Patients	60	23.5	40	21.6			13.2	0	1.6		Faust, 1924
Peiping	Patients	13617	3	33.4	5.3			4.7	0.037	0.15	0.029	Faust, 1929
Peiping	Students	2647	1	42.59		1.704	0.27	5.94		0.27	0.11	Lin, 1924
Peiping	Beggars	100		75	10							Khaw and Hoeppli, 1931
Peiping	Autopsy	809	1	38	15.7	14.4	2.8	7.9		13.5		Hsü & Chow, 1938
Tsinan	General Patients	976	1.3	30.2	1.1			0.6				Morgan, ~~1929~~ 1927
Tsinan	Butchers	27	2	33.3								Chang, 1939
West Central Shansi	Patients	1015		55.3				0.7		0.2		Ourran and Feng, 1930
Lanchow, Kansu	Patients	92	Majority Once	44.6	1.1*			1.1*	1.1			Taylor, 1931
Ning Kiang, Shensi	Local People	57		57.89	1.75			3.50				Hsu, 1943
Paoching, Shensi	Wounded soldiers	88		40.90	20.45			2.27				Hsu, 1943
Sian, Shensi	Apparently healthy persons & patients	82		14.75	2.43							Hsu, 1943
Tienshui, Kansu	Apparently healthy persons & patients	41		63.10				2.43				Hsu, 1943
Lanchow, Kansu	Local People	206		33.98				0.48				Hsu, 1943
Sining, Tsinghai	Patients	236		48.72	0.41			1.27				Hsu, 1943
Shanghai	Students	1412		35.9		0.6		22.8				Yu, Chu, Wang & Tao, 1934
Shanghai	Students	538		23.21	4.02			30.36				Komiya, Kawana & Tao, 1936
Shanghai	Restaurant workers (Chinese)	181	1	35.35	68.75			51.93		+		Komiya, Kawana & Tao, 1936
Shanghai	Restaurant workers (Japanese)	109	1	32.11	21.10			52.29		+	+	Komiya, Kawana & Tao, 1936
Shanghai	Japanese students	2523	1	14.54	4.99			36.82		0.47	0.71	Komiya, Kawana & Tao, 1936
Shanghai	Girl students (Japanese)	303	1	23.43	8.91			37.29			0.99	Komiya, Kawana & Tao, 1936
Shanghai	Commercial School students (Japanese)	238	1	22.69	8.82			48.32			2.52	Komiya, Kawana & Tao, 1936
Shanghai	College students (Japanese)	127	1	24.40	11.81		*	37.00			3.14	Komiya, Kawana & Tao, 1936
Kao-Chiao, Shanghai	Rural people	1618	1	76.4	7.8			42.5				Chu, Liu, Ling & Zee, 1936
Shanghai	Patients	2888	1.8	28	26			40		0.3		Andrews, 1938
Soochow	Patients	1034		40.0	16.6			13.7				Li, 1924
Chenkiang	Soldiers	669	1	25.26	10.31							Chu & Yao, 1935
Yangchow	Patients	400		57.2		22.5		15.0				Tai, 1924
Nanking	School children	2877	1	34.58	0.09			5.70		0.31		Yao, Hsu & Ling, 1934
Nanking	Students of Military Academy	1408	1	17.12	5.11			7.74				Yao, Hsu & Ling, 1934
Nanking	Patients	5568	1	18.79	5.06			6.12		0.02		Yao, Hsu & Ling, 1934
Shiaoshan, Chekiang	Villagers	1120	1	38.04	0.89			12.32	0	0	0	Watt, 1937
Hankow	Patients	632	1	55.6	27			30	0.4	0.16	0.4	Andrews, 1931
Wuchang	Patients	359	3	54.3	22			36.2	0.3			Faust & Wassell, 1921
Wuchang	Patients	57	4.3	61.4	40.4			26.3	5.3	0		Faust, 1924
Chengtu	Patients	1578	1	36.76	3.77			5.45	0.06	0.13		Chang & Lin, 1940
Chengtu	School children	1011	1	82.49	0.009			14.84		0.009		Chang & Lin, 1940
Chengtu	Soldiers	241	1	68.89	34.02			12.45				Chang & Lin, 1940
Chengtu	"Old People"	66	1	57.58	3.03			19.70		1.52		Chang & Lin, 1940
Chengtu	College students	765	1	47.8	0.13			2.2		0.2		Williams, 1936-38
Mt. Omei Szechwan	Rural people	619	1	91.6	26.81			26.81		0.16		Williams, 1938
Foochow Area	Rice Villagers	Altogether 500 samples of human stools were collected and three slides were examined from each sample.		93.1	0			19.0	0	0		Faust & Kellogg, 1927
Foochow Area	Rice Villagers			76	4			36	0	0		Faust & Kellogg, 1927
Foochow Area	Mulberry Villagers			63	12			14	10	0		Faust & Kelllgg, 1927
Foochow Area	Mulberry Villagers			54	2			12	2	0		Faust & Kellogg, 1927
Foochow Area	Mountain Villagers			93.3	8.7			4.35	10.88	0		Faust & Kellogg, 1927
Foochow Area	Mountain Villagers (Hak Ka)			81.8	56.9			11.7	5.8	1.5		Faust & Kellogg, 1927
Foochow Area	Mountain Villagers (Hak Ka)			100	55.2			19.2	12	0		Faust & Kellogg, 1927
Amoy		220		32.84		2.19		5.84				Ishii et al, 1929
South Fukien	Patients	8000		78	11			11				Maxwell, 1921
Canton	Patients	797		16.43		1.00		5.28				Otto, 1925-1934
Hainan Islands	School children	136	1	81.61	1.47			48.52				Kobayashi et al, 1940
Hainan Islands	Adult people	312	1	75.64	6.09			51.38	0.32			Kobayashi et al, 1940
Kwei-Yang Kweichow	Children	823	1	91.86				22.36	0.85	0.12		Lin & Yao, 1936
Ko-chiu, Yunnan	Children	169	1	92.31				35.50	0	0		Lin & Yao, 1936
Ko-chiu, Yunnan	Mine workers	106	1	92.45				24.91	0	0		Lin & Yao, 1936
Ning-erh, Yunnan	Children	98	1	88.77				17.37	0	0		Lin & Yao, 1936
Ssu-mao, Yunnan	Children	88	1	65.91				0	0	0		Lin & Yao, 1936

* Not found in local people.

TABLE II. - INTESTINAL TREMATODES, RESULTS OF FECAL EXAMINATIONS MADE IN DIFFERENT PARTS OF CHINA

Locality	Composition of Population	Total No. Examined	Average No. of Examination Per Person	Incidence in Percentage: Faciolapsis buski	Clonorchis sinensis	Paragonimus	Schistosoma japonicum	Investigater and Date
Pinchiang		220						LIN ~~Swee~~ & Wu, 1927
Pinchiang		350			0.6	0.3		~~Swee~~ LIN & Wu, 1927
Peiping	Patients	60	23.5		0		0	Faust, 1924
Peiping	Patients	13617	3	0.066	0.62	0.007	0.022	Faust, 1929
Peiping	Students	2461	1	0.53	0.08		0.037	Lin, 1924
Peiping	Autopsy	809	1	0.124				Hsü & Chow, 1938
West Central Shansi	Patients	1015						Curran & Feng, 1930
Shanghai	Students	1412		1.6	0.3			Yu, Chu, Wang and Tao, 1934
Shanghai	Students	538			2.23			Komiya, Kawana, and Tao, 1936
Shanghai	Restaurant workers (Chinese)	181	1	+	7.18			Komiya, Kawana and Tao, 1936
Shanghai	Restaurant workers (Japanese)	109	1		21.10			Komiya, Kawana and Tao, 1936
Shanghai	Japanese Students	2523	1		2.73			Komiya, Kawana and Tao, 1936
Shanghai	Girl Students (Japanese)	303	1		7.59			Komiya, Kawana and Tao, 1936
Shanghai	Commercial School Students (Japanese)	238	1		5.04			Komiya, Kawana and Tao, 1936
Shanghai	College Students (Japanese)	127	1		1.57			Komiya, Kawana and Tao, 1936
Shanghai	Patients	2888	1.8	2.0	2.2	0.04	4.4	Andrews, 1938
Soochow	Patients	1034		0.8			3.1	Li, 1924
Chenkiang	Soldiers	669	1	0.60			6.87	Chu and Yao, 1935
Yangchow	Patients	400		2.2			7.0	Tai, 1924
Nanking	School children	2877	1					Yao, Hsu and Ling, 1934
Nanking	Students of Military Academy	1408	1	0.07	0.99			Yao, Hsu and Ling, 1934
Nanking	Patients	5568	1	0.48	0.34		0.29	Yao, Hsu and Ling, 1934
Shiaoshan, Chekiang	Villagers	1120	1	83.84	0		0	Watt, 1937
Hankow	Patients	632	1	5	8		5	Andrews, 1931
Wuchang	Patients	359		0.6			3.6	Faust & Wassell, 1921
Wuchang	Patients	57	4.3	0	1.8		7	Faust, 1924
Chengtu	Patients	1578	1	0.63	0.19		0.13	Chang & Lin, 1940
Chengtu	Soldiers	241	1		1.66			Chang & Lin, 1940
Foochow Area	Rice Villagers	Altogether 500 samples of human stools were collected and 3 slides from each sample were examined.		0			0	Faust & Kellogg, 1927
Foochow Area	Rice Villagers			4.0			0	Faust & Kellogg, 1927
Foochow Area	Mulberry Villagers			0			0	Faust & Kellogg, 1927
Foochow Area	Mulberry Villagers			0			0	Faust & Kellogg, 1927
Foochow Area	Mountain Villagers			0			2.17	Faust & Kellogg, 1927
Foochow Area	Mountain Villagers (Hak Ka)			0			0	Faust & Kellogg, 1927
Foochow Area	Mountain Villagers (Hak Ka)			0			2.4	Faust & Kellogg, 1927
Amoy		220					1.46	Ishii et al, 1929
Canton	Patients	797		0.62	18.06			Otto, 1925-1934
Hainan Island	Adult People	312	1			0.32		Kobayashi et al, 1940

TABLE III. - INTESTINAL CESTODES, RESULTS OF FECAL EXAMINATIONS MADE IN DIFFERENT PARTS OF CHINA.

Locality	Composition of Population	Total No. Examined	Average No. of Examination Per Person	Incidence in Percentage				Investigator and Date
				Taenia spp	Taenia solium	Taenia saginata	Hymenolepis Nana	
Pinchiang		220			0.5			~~Swee~~ Lin & Wu, 1927
Pinchiang		350			0.6			~~Swee~~ Lin & Wu, 1927
Peiping	Patients	60	23.5			1.6	6.6	Faust, 1924
Peiping	Patients	13617	3	0.57			0.38	Faust, 1929
Peiping	Students	2461			0.037		0.18	Lin, 1924
Peiping	Autopsy	809				0.494		Hsü & Chow, 1938
Tsinan	General Patients	976	1.3	0.7				Morgan, ~~1929~~ 1927
Tsinan	Butchers	27	2		3.7			Chang, 1939
West Central Shansi	Patients	1015					0.3	Curran & Feng, 1930
Lanchow, Kansu	Patients	92				2.2		Taylor, 1931
Sian, Shensi	Healthy people and patients	82					2.44	Hsü, 1943
Sining, Tsinghai	Patients	236		0.42				Hsü, 1943
Shanghai	Patients	2888	1.8	0.2			0.04	Andrews, 1938
Shanghai	Japanese Students	2523					0.11	Komiya, Kawana & Tao, 1936
Nanking	School children	2877	1				0.07	Yao, Hsü & Ling, 1934
Nanking	Students of Military Academy	1408	1	0.07			0.21	Yao, Hsü & Ling, 1934
Nanking	Patients	5568	1	0.07				Yao, Hsü & Ling, 1934
Shiaoshan, Chekiang	Villagers	1120	1	0				Watt, 1937
Hankow	Patients	632	1	0.15				Andrews, ~~1933~~ 1931
Wuchang	Patients	57	4.3			0	7	Faust, 1924
Chengtu	Patients	1578	1	0.25		0.06		Chang & Lin, 1940
Canton	Patients	797				0.25		Otto, 1925-1934

TABLE IV. INTESTINAL PROTOZOA. RESULTS OF FECAL EXAMINATIONS MADE IN DIFFERENT PARTS OF CHINA.

Locality	Composition of Population	Total No. Examined	Average No. of Examination Per Person	Incidence in Percentage							Investigator and Date
				Endamoeba histolytica	Endamoeba coli	Endolimax nana	Iodamoeba buetschlii	Giardia lamblia	Trichomonas hominis	Chilomastix mesnili	
Peiping	Healthy and hospital population	816	Corrected to 6	29.5	11.7	40.1	13.0	10.0	4.5	6.0	Kessel & Svensson, 1924
Peiping	Patients	60	23.5	20.0	20.0	0.0	3.3	3.3	16.6	8.8	Faust, 1924
Peiping	Hospital Patients	13,617	3	15.2	14.5	21.6	4.6	5.02	1.77	3.19	Faust, 1929
Peiping		1,244		21.56	85.74	49.15	30.33	9.76		20.5	Svensson, 1931
Peiping	Beggars	100		30.6	83.9	52	42.8	1.35	12	10.4	Khaw & Hoeppli, 1931
Tsinan	Mostly Patients	976	1.3	7.1	1.5	0.2	0.7	0.6	1.4		Morgan, 1927
Tsinan	Country Family (1st)	671	1	25.3	35.0	20.7	16.2	3.0			Winfield & Chin, 1939
Tsinan	Country Family (2nd)	670	1	14.2	30.5	10.0	4.9	0.3			Winfield & Chin, 1939
Tsinan	Soldiers	393	1	16.0	27.4	13.7	3.0	5.0			Winfield & Chin, 1939
Tsinan	Primary School Children	700	1	12.6	18.1	14.0	4.3	9.3			Winfield & Chin, 1939
Tsinan	Tung Chia Chuang People	965	1	11.8	25.8	8.3	3.4	3.9			Winfield & Chin, 1939
Tsinan	University Students	216	1	11.1	17.1	12.0	6.0	0.9			Winfield & Chin, 1939
Tsinan	City Family	545	1	10.6	23.9	16.7	6.2	4.0			Winfield & Chin, 1939
Tsinan	Provincial School of Dramatics	133	1	7.6	9.0	11.2	3.7	7.5			Winfield & Chin, 1939
Tsinan	Hospital Patients	325	1	4.3	12.9	7.1	3.1	4.9			Winfield & Chin, 1939
Tsinan	Butchers	27	2	40.7	33.3	14.8	18.5	7.4			Chang, 1939
West Central Shansi		1,135	2.5	15.0	47.7	35.6	19.0	9.2	11.1	15.7	Curran & Feng, 1930
Lanchow, Kansu		92	Majority 1	5.4	31.5	10.0	6.7	5.4	1.1	6.5	Taylor, 1931
Ningkiang, Shensi	Local People	57			10.52			3.5			Hsu, 1943
Paocheng, Shensi	Wounded soldiers	88		2.27	1.10		1.10				Hsu, 1943
Sian, Shensi	Healthy People and Patients	82		2.43	13.41		1.21	2.43	6.09		Hsu, 1943
Tienshui, Kansu	Healthy girls and Patients	41		2.43	2.43			2.43			Hsu, 1943
Lanchow, Kansu	Local People	206		1.94	7.76		0.97	0.48	0.48		Hsu, 1943
Sining, Tsinghai	Data Secured from Laboratory or Hospital	236		0.41	15.25	2.54	2.96	0.41			Hsu, 1943
Kao-Chiao, Shanghai	Mostly School Children	914	1	0.2	14.3	3.2	1.8	7.3	0.1	0.0	Chu, Liu, Ling and Zee, 1936
Kao-Chiao, Shanghai	Mostly School Children	914	Corrected to 6	0.5	30.4	6.8	6.0	17.3	1.0	0.0	Chu, Liu, Ling and Zee, 1936
Shanghai	Hospital Patients	2,888	1.8	4.3	10.8	8.3	1.8	5.0	2.5	0.6	Andrews, 1938
Nanking	Primary School Children	2,877	1	1.43	16.41	1.91	2.26	5.80	0.04		Yao, Hsu and Ling, 1934
Nanking	Students of Military Academy	1,408	1	3.98	19.11	3.91	0.85	1.92			Yao, Hsu and Ling, 1934
Nanking	Hospital Patients	5,568	1	0.61	8.10	0.70	0.11	2.88	1.17	1.10	Yao, Hsu and Ling, 1934
Wuchang	Hospital Patients	359	3	2.5	5.0			3.0	0.6		Faust & Wassell, 1921
Wuchang	Hospital Patients	57	4.3	50.9	31.6	10.5	0	5.3	22.8	0	Faust, 1924
Hankow	Flood Refugee Patients	632	1	15	6.6	0.6	0.3	2.6	9.4	1.2	Andrews, 1931
Chengtu	University Students	765	1	5.8	6.7	1.1	0.9	1.2	0.2		Williams, 1936-1938
Mount Omei	Rural People	619	1	7.0	12.0	0.8	0.32	0.16	0.16		Williams, 1938
Chengtu	Hospital Patients	1,578	1	6.34	5.70	0.38	0.63	1.01	0.06	0.12	Chang & Lin, 1940
Chengtu	School Children	457	1	0.88	8.10	1.09	1.37	1.09	0	0.22	Chang & Lin, 1940
Chengtu	Soldiers	241	1	9.13	16.18	0.83	1.24	2.49	0.83	1.66	Chang & Lin, 1940
Chengtu	"Old People"	66	1	1.52	15.15	4.54	0	1.52	0	1.52	Chang & Lin, 1940
Foochow, Fukien	Rice Villagers	Altogether about 500	3 slides each person	7.6	1.6	3.8	0	1.9			Faust & Kellogg, 1927
Foochow, Fukien	Rice Villagers			12.0	14.0	8.0	2.0	0			Faust & Kellogg, 1927
Foochow, Fukien	Mulberry Villagers			3.0	3.0	6.0	0	0			Faust & Kellogg, 1927
Foochow, Fukien	Mulberry Villagers			1.0	5.0	7.0	1.0	3.0			Faust & Kellogg, 1927
Foochow, Fukien	Mountain Villagers			3.3	6.6	4.2	0	2.17			Faust & Kellogg, 1927
Foochow, Fukien	Mountain Villagers (Hak Ka)			3.6	5.4	3.6	1.8	1.8			Faust & Kellogg, 1927
Foochow, Fukien	Mountain Villagers (Hak Ka)			3.3	4.7	2.3	0	0			Faust & Kellogg, 1927
Kweiyang, Kweichow	School Children	823	1	0.36	10.94	5.47	0.85		2.67		Lin & Yao, 1936
Ko-Chiu, Yunnan	School Children	169	1	1.18	17.16	10.06	2.37		4.14		Lin & Yao, 1936
Ko-Chiu, Yunnan	Mine Workers	106	1	2.83	16.04	10.38	3.77		2.83		Lin & Yao, 1936
Ning-erh, Yunnan	School Children	98	1	0	5.10	4.08	0		5.10		Lin & Yao, 1936
Ssu-mao, Yunnan	School Children	88	1	0	4.55	5.68	0		6.82		Lin & Yao, 1936